# THE ENGINEER

JANUARY 8, 1954

## New Year Honours

THE New Year Honours List, which was published on Friday last, January 1st, includes the following names :—Viscount : the Right Honourable Baron Leathers, C.H., until recently Secretary of State for the Co-ordination of Transport, Fuel and Power ; Knights Bachelor : Mr. D. F. Anderson, president of the Chamber of Shipping of the United Kingdom ; Mr. G. F. Earle, chairman of Associated Portland Cement Manufacturers, Ltd.; Mr. J. B. Elliot, chairman of London Transport Executive ; Mr. E. H. Lever, chairman and chief executive of Steel Company of Wales, Ltd.; Mr. Oliver Lyle ; Mr. H. J. B. Manzoni, M.I.C.E., city engineer and surveyor, Birmingham ; Mr. E. T. Paris, chief scientific adviser, Home Office ; Mr. W. C. Puckey, of Hoover, Ltd.; and Mr. W. G. Radley, engineer-in-chief, General Post Office. In the Order of the Bath, the K.C.B. is conferred upon Sir James Helmore, Permanent Secretary, Ministry of Supply ; Mr. V. G. Shepheard, Director of Naval Construction, Admiralty ; and Lieutenant-General Sir Kenneth McLean, late Corps of Royal Engineers ; and the following become C.B.:—Rear-Admiral (E) Iain Maclean ; Rear-Admiral (E) Leopold E. Rebbeck ; Rear-Admiral (E) J. W. Wishart ; Major-General F. M. Hext, R.E.M.E.; Major-General Stephen Lamplugh, late R.E.; Mr. A. T. Barnard, chief superintendent, Royal Ordnance Factories, Woolwich ; and Mr. H. J. Watson, deputy director of dockyards, Admiralty. In the Order of St. Michael and St. George, the C.M.G. is conferred upon Mr. N. C. Robertson, director-general of electronics production, Ministry of Supply ; Mr. A. W. Savage, director-general of civil aviation, Malaya-Borneo region ; and Mr. W. Venner, general manager of the Sierra Leone Railway. Awards in the Order of the British Empire include :—K.B.E.: Air Marshal Richard Williams, director-general of civil aviation in Australia ; Sir Thomas Bennett, chairman of Crawley Development Corporation ; Mr. L. P. Lord, chairman and managing director of British Motor Corporation, Ltd.; and Commander S. S. Crichton Mitchell, R.N. (ret.), controller of guided weapons and electronics, Ministry of Supply. The following become C.B.E.:—Mr. J. A. Burnett, divisional road engineer, Scotland, Ministry of Transport ; Mr. N. C. Chapling, managing director, Cable and Wireless, Ltd.; Mr. H. W. Coales, deputy chief engineer, Ministry of Housing and Local Government ; Mr. St. J. de Holt Elstub, director of Metals Division, Imperial Chemical Industries, Ltd.; Mr. R. D. Gwyther, M.I.C.E., senior partner, Coode and Partners ; Mr. W. K. Hutchison, chairman, South-Eastern Gas Board ; Mr. B. P. Ingamells, director of merchant shipbuilding and repairs, Admiralty ; Mr. C. R. King, chairman, East Midlands Electricity Board ; Mr. G. J. S. Little, assistant engineer-in-chief, General Post Office ; Mr. A. G. B. Owen, joint managing director of Rubery, Owen and Co., Ltd.; Mr. G. Darnley Smith, managing director of Bush Radio, Ltd.; Mr. B. A. Southgate, director of the Water Pollution Research Laboratory, D.S.I.R.; Captain G. Villar, R.N. (ret.), general manager (Southampton) and director of John I. Thornycroft and Co., Ltd.; Mr. J. L. Brown, director of public works, Cyprus ; and, in the Pakistan list, Colonel J. R. Connor, Royal Engineers.

## Prospects of the Shipbuilding Industry

THE position and prospects of the shipbuilding industry were reviewed in a New Year message from Mr. J. W. Elliott, C.B.E., the president of the Shipbuilding Conference. He drew attention to the fact that the total of new merchant vessels ordered in 1953 amounted to 500,000 tons gross, and that figure represented only one-third of the orders placed in 1952 and only one-eighth of the tonnage ordered in 1951. Such a position, he continued, served as a sharp reminder to those engaged in the industry, and those associated with it, that world conditions had changed considerably since the end of the war in Korea. Freight rates had fallen and also the value of ships, so that in order to encourage the placing of orders it was necessary to increase output and expedite the delivery of ships, already on the order books, by economic methods. Mr. Elliott said that the rapidly declining flow of the volume of orders was worldwide and coincided with the emergence of much keener competition from the Continental countries. With regard to the question of the supply of steel, he affirmed that difficulties had continued during 1953, and that these had restricted the launching out to an amount considerably less than the maximum now possible as a result of post-war modernisation of the shipyards. He expressed a hope that a solution for this problem, particularly the supply of steel plate, would be found during 1954. Although the large tonnage of oil tankers under construction and on order meant work for some years ahead, this situation did not apply to all yards, and many, Mr. Elliott stated, would welcome new orders to replace work in hand.

## National Coal Board Engineering Appointment

THE National Coal Board has appointed Mr. Leslie Henry Daniel to be the Director of its Central Engineering Establishment, which is to be formed at Bretley, Derbyshire. This new establishment will have two main functions, the development of new machinery and equipment being one and the testing of machinery, ropes and new materials, together with the development of improved methods of routine testing, being the other. Mr. Daniel, who is forty-seven, is at present deputy chief engineer of the Ministry of Supply's Fighting Vehicles Research and Development Establishment. After obtaining an M.Sc. in electrical and mechanical engineering at Queen Mary College in 1929, Mr. Daniel became a student apprentice with the British Thomson-Houston Company, Ltd., until joining the laboratory staff of the British Electrical and Allied Industries Research Association in 1931. He joined the Ministry of Supply in 1946 as senior principal scientific officer and obtained his present post of deputy chief engineer in 1949.

## British Electricity Authority Bulk Supply Tariff

As foreshadowed in its fifth annual report, the British Electricity Authority has given notice of a revised tariff for the supply of electricity to Area Boards, to be effective from April 1, 1954. The tariff incorporates, as hitherto, a fixed charge per kilowatt of maximum demand and a running charge per unit consumed, applying on a uniform basis to all Area Boards and subject only to regional fuel cost adjustment. Overall the Area Boards will pay approximately 1 per cent more for their supplies than under the present tariff, but the incidence of this increase on individual Boards will vary. The kilowatt demand charge has been raised from £4 5s. 6d. to £4 15s. to reflect increased capital charges and other fixed costs, while the running charge, with its associated fuel price variation, has been reduced to reflect the continuing improvement in thermal efficiency. In the new tariff a figure of 60s. has been adopted for the basic cost per ton of fuel as being more in keeping with the current price levels than the figure of 38s., on which the tariff has been based for some years. The basic running charge is therefore revised from 0·33d. per unit to 0·5d. per unit. The fuel price adjustment figure is reduced from 0·0007d. to 0·00065d. per penny variation in the cost per ton of fuel in the respective areas. The demand will be measured on weekdays between the hours of 7 a.m. and 7 p.m. from Monday to Friday and 7 a.m. to 12 noon on Saturday. If the demand so measured is exceeded by the demand at other times there will be no additional charge : thus the new tariff affords further encouragement to Area Boards to develop off-peak loads and so improve the national load factor.

## Bedwas Colliery Explosion Report

THE Ministry of Fuel and Power report has been published on the causes of, and the circumstances attending, the explosion which occurred at the Bedwas Colliery, Monmouthshire, on October 10, 1952. In this explosion one man was killed and twenty others were injured. The investigation into the causes of the explosion was conducted by Mr. T. A. Jones, H.M. Divisional Inspector of Mines, who came to the conclusion that there was a mildly explosive mixture of methane and air in the vicinity of the explosion. This explosive mixture was ignited when an attempt was made to relight a Cambrian "Midget" internal igniter flame safety lamp. This external ignition was not due to any defect in the lamp, but was the result of an abnormal and highly improbable effect of phyrophor ground off by the operation of the relighter mechanism. In his observations Mr. Jones says that one of the most disturbing factors of the explosion was that the igniting medium was a flame safety lamp of an approved type, and with no defect which might have reduced its standard of safety. The suitability of the phyrophor relighter device for use in the flame safety lamp had previously been questioned—and it had been criticised by Mr. A. M. (now Sir Andrew) Bryan in his report into an explosion in 1947 at Ingham Colliery in Yorkshire. Mr. Bryan had recommended that an effort should be made to devise a more positive and efficient relighter device, and Mr. Jones observes that the explosion at Bedwas Colliery gives additional weight to the recommendation.

## Sir Frederick Mills, Bart.

WE record with regret the death of Sir Frederick Mills, Bart., which occurred, at Eastbourne, on Thursday of last week, December 31st. For many years he occupied a prominent position in the British iron and steel industry and was, for more than thirty years, closely associated with the Ebbw Vale Steel, Coal and Iron Company. Sir Frederick, who was eighty-eight, was born at West Hartlepool, and was educated at the Durham University College of Science. He then served a five-year engineering apprenticeship with Palmers' Shipbuilding and Iron Company, Ltd., at Jarrow, and subsequently became the first steel works manager of the Stockton Malleable Works, which later became part of the South Durham Steel Company, Ltd. In 1896, Sir Frederick became manager of the Glasgow Iron Company's steel works at Wishaw, where he remained for three years until being appointed general manager of the Ebbw Vale works. In the succeeding years he initiated and successfully carried out a number of schemes for the modernisation and extension of the works. Sir Frederick became managing director of the Ebbw Vale Steel, Coal and Iron Company in 1911 and was appointed chairman and managing director in 1919. He relinquished those offices ten years later in order to devote himself to politics, serving as Member of Parliament for Leyton East continuously from 1931 until his retirement in 1945. Sir Frederick became a member of the Iron and Steel Institute in 1896, was elected to its council in 1914, and served as president in 1925–26.

# Civil Engineering in 1953

No. II—(*Continued from page 5, January 1st*)

THE British Electricity Authority's programme of power station construction was reviewed last week in our article "Electrical Engineering in 1953," where brief mention was made of the constructional work at several new power stations. But the purely civil engineering aspect of this work is of sufficient importance to merit a more detailed account here, for a substantial part of the civil engineering effort of 1953, as in previous years, was concerned with the B.E.A.'s new power stations.

A good idea of the substructure and riverside works for a new power station is given by the illustration on Plate 3, which shows the site of Marchwood power station, on the south bank of the estuary of the River Test, near Southampton. The station will ultimately be of 480MW capacity. Work started in August, 1952; the site is low lying and covered with estuarine mud to a thickness varying from 3ft to 18ft. The power-house and all other major structures are founded on precast concrete piles driven into the Bracklesham sand bed. The works involve the reclamation of approximately 23 acres of land, 500,000 cubic yards of filling being obtained from borrow pits excavated on the site. These borrow pits will ultimately be used for the disposal of fine ash when the station is in operation.

The site filling is retained along the river frontage by a pitched embankment formed with tipped borrow pit hoggin, the estuarine mud having been removed initially by dredging. The cooling water intake, pump-house and outfall are situated along the river frontage at the west and east end of the site respectively. An 800ft long coaling wharf is also provided and will be equipped to unload from 4600-ton colliers. Access to the wharf is given by a dredged basin and approach channel, involving the disposal of approximately 1,000,000 cubic yards of material. The cooling water is circulated in twin reinforced concrete culverts supported on precast piles, the length of culvert behind the wharf being designed as a relieving platform for the latter, thus giving substantial overall economies.

It is estimated that the foundation work at Marchwood will be completed in the summer of 1955, shortly before the commissioning date of the first 60MW turbo-alternator set. Work on the superstructure will start early this year. The consulting engineers to the British Electricity Authority are Sir William Halcrow and Partners, to whom Messrs. Farmer and Dark are consulting architects, and the main civil engineering contractor is Sir Robert McAlpine and Sons, Ltd. Alex. Findlay and Co., Ltd., is the contractor for structural steelwork, the electrical and mechanical work being under the direction of the Southern Division of the British Electricity Authority.

Carmarthen Bay power station, on the Burry estuary, was illustrated in Plate 2 last week, and was one of the B.E.A.'s stations commissioned during 1953. It stands on a site of 214 acres, which was originally marginal coastal land. Trial borings revealed that below superficial slag deposits there existed some 20ft of fine brown sand, below which was 40ft of grey silty sand interlaced with clay seams. At a depth of 65ft sandstone rock was found to exist for a considerable depth. The general level of the site was at +21 O.D., with a general standing water level at +8 O.D. Thus it was essential that the heavy buildings should be piled so that they could be supported on the rock.

A dewatering system had to be used for the boiler and turbine house excavations, which were at +3 and −12 O.D. respectively; the work was then carried out with a battered excavation. About 5300 reinforced concrete piles, 14in square in section and from 40ft to 55ft long, were driven for the main buildings, and about 275 steel box piles with an average length of 60ft were driven for the ancillary buildings. The foundations were tanked with asphalt, because of the high ground water level. The superstructures are of fabricated steelwork faced with Tondu brick; 16,000 tons of steel is needed to complete the main buildings, consisting of a turbine house, 750ft long, 120ft wide and 60ft high, and three boiler houses at right angles to it, each about 220ft long by 184ft wide by 115ft high.

The pump house on the foreshore is approximately 241ft long by 134ft wide by 50ft high, with foundations down to rock level at −55 O.D. In the Burry estuary there is a tidal range of 33ft and to ensure that the suction inlets of the circulating water pumps were drowned at all states of the tide it was necessary to construct a very deep pump house. Excavation proceeded inside a steel sheet piled cofferdam, inside which six reinforced concrete diaphragms were cast, forming a number of floors, and circular openings were formed within these diaphragms. After casting the first diaphragm at 5ft below ground level excavation proceeded underneath it until the level of the next diaphragm was reached, which was then cast, the sequence being repeated until the base of the pump house was built. The internal reinforced concrete walls were then built up from the base around the various diaphragm openings, forming a number of deep cylindrical chambers, which were used for housing the pumps, penstocks and associated equipment; the interstices on the outside of the cylindrical walls not required for housing plant were backfilled with sand. The cofferdam piling was left in place as part of the structure, the diaphragm reinforcement having been welded to it to hold the diaphragms in position during construction.

The culverts for the circulating water system had also to be constructed in part on the foreshore. Construction was carried out in sections inside sheet steel cofferdams. The excavated sand was pumped from the cofferdams on to the foreshore, the inlet culvert being approximately 300ft long with an invert level of −25 O.D., and the discharge culvert being 560ft long with an invert level of −20 O.D. The culverts are constructed of reinforced concrete. A travelling shutter was used for the construction of the single intake and outfall culverts, which have internal cross section dimensions of 19ft by 15ft. Approximately 3100 tons of sheet steel piling were used for the construction of the circulating water pump house and associated works. Balfour Beatty and Co., Ltd., acted both as consultant and contractor to the B.E.A. for the works at Carmarthen Bay described here.

Construction of the Portishead "B" power station, near Bristol, was commenced in 1951. It provides for six 60MW turbo-alternator sets. During 1953 the greater part of the foundations for the first third of the power station was completed, and erection of the structural steelwork started. The construction of the foundations for the second third of the station was also in progress. Fig. 7 shows the progress made by last August.

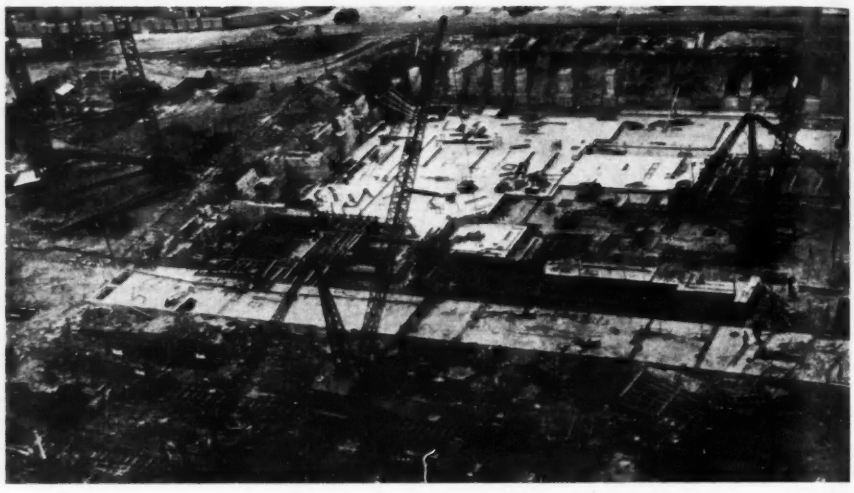


**Fig. 7—Foundation Work at Portishead "B" Power Station**

Cooling water at Portishead will be drawn from the River Severn through four concrete lined tunnels of horseshoe section, equivalent to 9ft diameter, the outfalls of which are below low-water level. All four of the tunnels were driven in free air from the power station out under the foreshore. The rock formations encountered were complex and badly faulted and fractured. It was therefore necessary to use steel colliery arches and poling bars to support the rock during driving. The seaward end of each tunnel will be driven in compressed air and air locks were erected in two of the tunnels, ready to continue driving again early this year.

The tunnels are being lined with concrete, and a "Pressweld" placer and a 40ft long steel shutter are being used for placing the concrete in the sides and arch of the tunnel. Over half of the lengths of two of the tunnels was concreted by the end of the year. A dredged channel will be formed at the tunnel outfalls and, due to the exposed position and tidal range of about 50ft, this channel is to be excavated from shore-based plant. The preparation of this plant, which includes a

10-ton derrick on a carriage for moving up and down the foreshore and a half-tide drilling platform were completed and the excavation of the channel will soon be started.

Included in the ancillary works for this station are two cable tunnels under the sea lock which serves the Portishead dock. The access shafts and tunnels are cast iron lined and the tunnels were driven in compressed air. The tunnels are only 22ft below the base slab of the lock, which is of masonry construction, and an air pressure of 30 lb per square inch was required in driving the tunnels. This work was generally completed and 132kV cables are now being laid in the tunnels. The consulting engineers to the British Electricity Authority for this work at Portishead are Sir William Halcrow and Partners, to whom Mr. Augustus Bryett is consulting architect. The civil engineering contractor is Charles Brand and Son, Ltd., and the structural steelwork contractor is Sir William Arrol and Co., Ltd.

Sir William Halcrow and Partners were also the B.E.A.'s consultants for the study of problems arising from the abstraction of cooling waters from the estuary of the Usk at Uskmouth power station (the consultants for the station itself being L. G. Mouchel and Partners, Ltd.), and in designing these river works extensive studies on a model of a reach of the estuary were carried out since the hydraulic problems involved were very complex, and the Usk is a well-known salmon river. A rise of tide of nearly 50ft at springs takes place. The design is unusual in that the intake is situated downstream and the outfall upstream. The most critical conditions arise during the last of the ebb tide, but even at this time the flow of tidal water out of the estuary is many times greater than the natural fresh water flow of the River Usk. A model was used to study the distribution of heated water over the cross section of the estuary to verify that there would be no concentration of heated water likely to constitute a barrier to fish running upstream. To counter any possibility of the heating of the water depriving it of its oxygen the outfall was designed to aerate the outgoing water; Fig. 8 shows this structure carried out in reinforced concrete by the contractor for the river works, Holloway Brothers (London), Ltd.

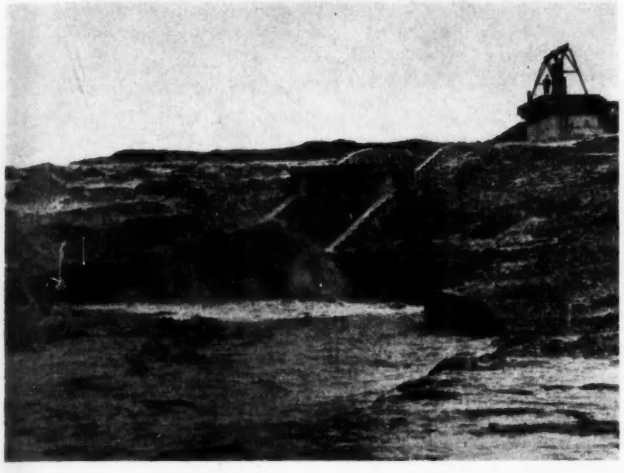


Fig. 8—Uskmouth Power Station River Outfall with Flow of 240 Cusecs

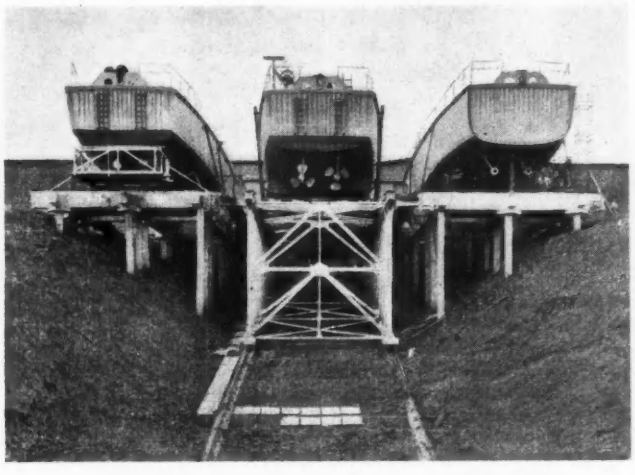


Fig. 9—Auxiliary Carriage at Top of Beaumaris Slipway

### Some Dock and Harbour Works

Within the space of this review we can only give one or two examples of the dock and harbour works in Great Britain during 1953. Major works in progress during the year included the Mersey Docks and Harbour Board's scheme for the improvement of the Langton-Canada docks, and the Manchester Ship Canal Company's oil dock at Eastham, which was nearing completion by the end of the year. A £1,500,000 scheme for improvements at Tilbury Docks was authorised by the Port of London Authority during the year; the main dock is to be widened to 900ft, and a monolith quay wall 843ft long is to be built. The car ferry terminal at Dover was inaugurated on June 31st, the pneumatic buffers installed in the new work were described in our issue of October 23rd last.

Plate 3 illustrates the new dry dock which is being built for Smith's Dock Company, Ltd., at North Shields. Good progress was made during the year, and it is anticipated that the dock will be finished this spring. The design of the dock is of particular interest for two reasons. The dock walls are of steel sheet piling; it is believed that steel piling has not been used previously for dry dock walls and it is claimed that it is substantially less costly than the traditional mass concrete walls. A novel feature of the pumping discharge of the dock is the elimination of the usual non-return or self-closing valves. In this instance the discharge is pumped through 5ft diameter concrete pipes in the form of a siphon with air breaker valves at the crest. These valves come into operation immediately the main pumps are cut out and thereby prevent the water from siphoning back from the river into the dock.

The dock is 709ft long, 95ft wide at the entrance, and has a depth of 27ft on the cill at high water ordinary spring tides; it will be the largest privately owned dock on the East Coast of Great Britain, and will accommodate large oil tankers up to 38,000 tons deadweight. The dock will be equipped with a flap-type entrance gate. The pumping plant comprises two horizontal centrifugal pumping units for the main dewatering, with the usual auxiliary pumps for ballast water, drainage, &c. There are to be three dockside cranes, ranging from 5 tons to 30 tons in capacity, and a new platers' shed equipped for modern repair methods. A comprehensive arrangement of dockside services is being provided comprising a boiler-house with oil-fired boilers to provide steam for tank cleaning, &c., compressed air services, ballast water, fresh water and electric power and lighting mains for supply to ships in dock, and supply cables for welding sets, &c.

In addition to the dock, an extension of 380ft to the existing deep water quay is being constructed giving a total quay length of about 900ft. This quay is being supplied with services in a similar manner to the dock.

To construct the dock it has been necessary to excavate into the hillside behind the river frontage, and about 250,000 cubic yards of earth had to be removed before the dock itself could be started. The top of the bank is about 50ft above the dockside. An electric lift operating within a reinforced concrete tower serves from the bank to the dock cope level and also to the bottom of the dock, and will have a series of automatic devices to prevent travel below the cope when the dock is flooded, but will be able to remain in operation from the cope to the bank top. The consulting engineers for the whole project are T. F. Burns and Partners, and the main contractor is Holloway Brothers (London), Ltd.

As an example of the smaller maritime works of 1953, some details are given of the Beaumaris slipway, constructed in Anglesey for the Saunders-Roe (Anglesey) Company, which is intended for launching small craft up to 300 tons light displacement. Owing to the peculiarities of the locality it was not practicable to devise a launching way of the usual kind. The principal difficulty lay in the fact that the construction shed where the craft were to be fabricated was built on ground about 40ft above high water mark and only 300ft distant from the shore of the Straits. The beach itself was a very flat one, extending out a distance of 400ft from the shoreline before attaining the launching depth of 18ft. Any slipway to be effective would have had, more or less, to finish up at this flat slope. An important main road ran parallel with the shore between the construction sheds and the water. A curved auxiliary launching way had, therefore, to be built between the shed and the main road.

The craft after being built were first traversed sideways through the shed, each craft being mounted for this purpose upon three traversing rail bogies. On arrival at the slipway proper the bogies come on top of the launching carriage, which is itself mounted on rails so as to run up and down the slipway. This carriage on emerging from the construction shed passes on top of the auxiliary undercarriage.

The auxiliary undercarriage consists of the

Fig. 10—Double-Leaf Bascule Bridge at Victoria Dock, Aberdeen

lattice structure shown in Fig. 9, and it carries the craft and launching carriage. It moves down a very sharp curved incline at the bottom of which it fetches up so that the slipway carriage runs off smoothly, crosses over the main road upon a level crossing and then proceeds upon its way down the gently inclined railway to enter the water. The idea of having the rail tracks beneath the auxiliary carriage curved in a vertical plane is to change the angle of inclination of the ordinary launching carriage; whereas the latter emerges from the construction shed on a dead level track, it proceeds over the roadway on an inclined track. The auxiliary carriage, therefore, serves the double purpose of enabling the craft to carry out a steep downward movement while at the same time changing the angle of declivity at which it moves. All this is achieved without any interference with the even bedding of the craft upon the three original bogie supports. The consulting engineers for the Beaumaris slipway were Messrs. Maunsell, Posford and Pavry.

The bascule bridge at Aberdeen Docks, illustrated in Fig. 10, although not of large size, was a noteworthy achievement of 1953, for it incorporates a number of advances in design. The two moving leaves are of aluminium alloy, spanning 100ft; aluminium rivets were used in the construction of the spans, rivets up to $\frac{7}{8}$in diameter being successfully cold-driven. The deep pit normally required to accommodate the counterbalance of a bascule leaf was largely avoided in this bridge, by carrying the balance weight on an "A"-frame behind the leaf, the weight hanging on a rope which passes over a pulley and round a cam on the side of the moving leaf: as the leaf is raised or lowered, the cam gives the correct lever arm in all positions. Yet another novelty of the bridge is that the operating machinery is housed within a 5ft square portal girder which forms part of the moving leaf. The bridge was built, under the direction of the chief engineer of the Aberdeen Harbour Commissioners, Mr. John Anderson, by the Head Wrightson organisation. A full description of the novel points in its design and execution was given in THE ENGINEER of October 2nd last. British engineers have been showing considerable enterprise in building aluminium structures during the past two or three years, and another example of an aluminium structure completed in 1953—an aircraft hangar of 200ft span at Hatfield—was described in THE ENGINEER of January 23rd last.

### TWO MAJOR PROJECTS

Woodhead tunnel and the Haweswater aqueduct, both of them very large projects, have been under construction now for several years, and their progress has been noted in our previous annual civil engineering reviews. Woodhead tunnel was completed during 1953, although it is not yet open to traffic, and 1953 was the peak year in the construction of the Haweswater aqueduct, a large part of which comprises tunnelling contracts, there being 30 miles of tunnels along the 82-mile length of the aqueduct. The entire aqueduct is being built under the supervision of the engineer and manager of Manchester Corporation Waterworks, Mr. A. Atkinson.

The year saw the completion of the driving of the Haweswater tunnels, the emphasis on the tunnel contracts being on their concrete lining, which has a nominal thickness of 14in. On the 10¼-mile long Bowland Forest tunnel, for which the contractor is the Cementation Company, Ltd., the 8ft 6in internal diameter tunnel lining was completed and the final grouting behind the lining was nearing completion. At the Croasdale tunnel shaft, near the mid-point of the tunnel, crushed and screened aggregates and cement were stored in bins constructed in the 270ft deep shaft. The concrete was weigh-batched and mixed in a 2 cubic yard tilting drum mixer and transferred to trains of transit mixers for transport to the placing point. Here each transit mixer was hauled up an incline and the contents fed into a pneumatic placer, which discharged through a 6in diameter pipe to the crown of the tunnel to place the entire cylindrical lining in a single operation. Except for the weekend break placing was continuous, for the shutter design allowed a section to be struck at the far end, brought through the main length of shutter and re-erected at the placer end.

Continuous concreting by rather similar methods and using a similar shutter was in progress on the Rossendale tunnels, which, together with the connecting conduit under

Fig. 11—Track Laying in Woodhead Tunnel

the River Irwell, form a continuous tunnel 11·6 miles long. The contractor in this case is Edmund Nuttall, Sons and Co. (London), Ltd. Standard weigh-batching equipment was located outside the tunnel. Batches of materials comprising one mix of concrete were taken up the tunnel in trucks and discharged on to a belt conveyor to feed a mixer near the placing point. By using a double drum mixer of ¼ cubic yard capacity it was possible to obtain the desired output of 30 cubic yards an hour from a mixer small enough to be accommodated in the restricted space in the tunnel. The mixer discharged into a pneumatic placer.

The methods briefly described above have enabled a high rate of lining to be maintained on the Bowland Forest tunnel, where 43,230ft of lining were placed in twelve months. The highest monthly output was obtained on the Rossendale tunnels, where 6000ft were placed in the thirty-one days of October, 1953. On the relatively short Marl Hill tunnel (2½ miles long), where the contractor is A. Waddington and Son, Ltd., where such a high output was not necessary, but the concrete was also being placed by pneumatic plant. In this case the process was not continuous and the invert was placed as a subsequent separate operation.

Good progress was also made on the steel pipe siphons of the aqueduct. Of the total length of 31 miles of 48in and 54in diameter pipes in the first pipeline to Heaton Park, only about 3¼ miles were still to be laid at the end of the year. The steel pipes were lined with bitumen and sheathed with bitumen reinforced by fibre glass and the *in situ* joints were for the most part made by welding. In most instances the pipes were laid in concrete beneath stream beds, but reinforced concrete pipe bridges are being constructed for crossing some of the larger rivers. Three-span arch rib bridges identical in design were used for both the River Ribble and the River Lune crossings ; prestressed concrete girder bridges were being built over the Rivers Calder and Hodder. All these bridges will eventually carry four lines of pipes.

Two other forms of construction have been used on the aqueduct. There are about 8 miles of " cut-and-cover " conduits of the same 8ft 6in diameter circular section as the tunnels. These were cast in 30ft to 40ft lengths between built-in contraction joints. In cases where the siphons are short and the pressures low, single pipes have been formed, 87in and 96in in diameter by welding together, at the site, curved sheets of steel to form continuous cores, which are strutted internally while a concrete surround is placed. The steel cores have still to be given a 1½in reinforced concrete lining, which is mainly protective. There will be about 3½ miles of this construction.

Fig. 11 shows a length of prefabricated track being laid in Woodhead tunnel. Track laying in the 3-mile length of this double-line tunnel was completed in seven weeks by the end of last September. The tunnel is lined with a minimum thickness of 21in of mass concrete. Work on the pilot tunnel started in February, 1949, and was completed in May, 1951 ; enlargement to the full size (30ft 6in wide) was carried out from as many as nine faces simultaneously, access being obtained from a system of by-pass tunnels driven parallel to and 50ft from the centre line of the tunnel, which will be put into service in the summer of 1954, at the same time as the completion of the electrification of the Manchester-Sheffield-Wath lines. The consulting engineers were Sir William Halcrow and Partners, and the contractor was Balfour, Beatty and Co., Ltd.

( *To be continued* )

# Royal Navy, 1953

*(By Our Naval Correspondent)*

No. II—( *Concluded from page 10, January 1st* )

## The Anti-Submarine Position To-day

A SOUND appreciation of the submarine position as it is to-day is made difficult by the lack of definite information of the number, age and efficiency of Russian submarines. Their number is believed to be about 360, including sixty in the Black Sea, but many of them are old or small and unsuitable for operations overseas. It would in fact be wrong to assume that a fast modern submarine would be lurking in the path of every convoy. On the other hand, Russia has had the assistance of German submarine technical experts and has built a large number of submarines since the war—a number sufficiently large (to say nothing of the 100 now reported to be under construction) to present a formidable menace to our sea communications. Measures, both for the detection and location of submarines have, however, improved immensely in recent years. A new British development is the three-barrelled mortar linked to an asdic set with an effective system of electronic fire control. The whole process, from detection to aiming the weapon, is automatic, the asdic set feeding the electronic fire control, and the fire control system training the mortar and discharging it electrically when the correct range is reached. Another remarkable weapon is the United States invented rocket launcher—also with an effective fire control system—which has already been installed in a number of ships of the United States Navy. It fires a relatively large rocket at a range considerably in excess of 1000 yards. The homing torpedo is also a very valuable addition to the armoury of anti-submarine missiles, though it will, of course, be used equally by submarines. This " guided missile " is a great improvement on the homing torpedo used by the German U-boats in the war, notably in the ability of its guiding mechanism to distinguish " noise decoys " from the sound of propellers.

In brief, a submarine has little chance of escaping destruction nowadays once she has come within range of the detecting ships. None the less, detection of a completely submerged submarine is a problem yet to be solved, for the effective range of detection is less than the attacking range of a submarine that decides to attack at long range using homing torpedoes. Moreover, the problem is accentuated by the ability of submarines to fire guided missiles. The United States Navy already has submarines which can carry two pilotless guided missiles capable of supersonic speed. One is carried in a launching device and the other in a deck hangar. It might well be, therefore, that Russia would employ a substantial number of her submarines strategically—to fire guided missiles at towns and centres of industry—as well, of course, as in laying mines. No special training, initiative or good judgment is required to make voyages, remaining submerged, to positions in the North Sea, each submarine firing two missiles at inland targets. It would, indeed, seem more profitable for Russia to employ her submarines in this way than to use them to attempt the difficult task of attacking a well-escorted convoy, which demands a higher standard of professional skill than her commanding officers, judging from her past naval history, seem likely to possess. To deal with this new menace, patrols would require to be established in a large number of likely areas, using helicopters and wartime frigates and other small craft equipped with modern detecting gear.

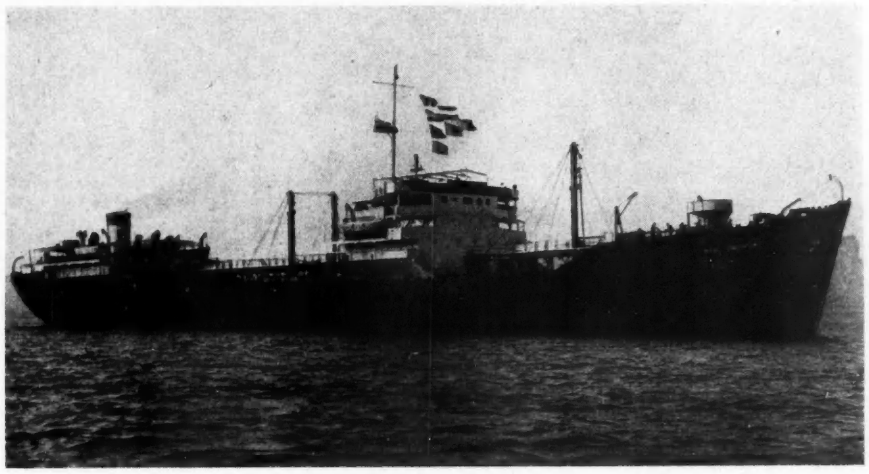


**Fig. 6—Royal Fleet Auxiliary Tanker " Wave Liberator "**

## The Fleet Air Arm

With two squadrons of " Attackers " and two of " Sea Hawks " now in service—all single-seater fighters powered by a " Nene " turbojet—some progress can at last be reported in the re-equipment of the Fleet Air Arm's nineteen front-line squadrons with jet aircraft. The " Attacker " was only intended as a stopgap in preparation for the faster carrier jets to come, but the straight-wing " Sea Hawk " is likely to remain the standard day interceptor for a considerable period. It was officially announced last year that two types of swept-wing twin jet machines are being developed for the Navy—one, to which super-priority has been given, a development of the Supermarine " 508 " as a high-speed interceptor, and the other a naval version of the de Havilland " 110 " as an all-weather fighter. A twin jet machine must be a relatively large aircraft, carrying a good deal of equipment, but it is believed

that in the new version of the Supermarine "508" the Royal Navy will have a carrier borne fighter with a higher performance than any land-based aeroplane. Past experience, however, indicates that this forecast needs to be treated with reserve. There is as yet no news of the prototype, and by the time the first squadron is equipped with this aircraft it may well no longer be the "fastest fighter in the world." A naval version of the "Venom NF," powered by a "Ghost" engine, is also in production as a two-seater day and night fighter, but there are no signs of the delivery of this aircraft for service, nor are any official details available. The Navy's future strike aircraft is to be the Westland "Wyvern," powered by a "Python" turboprop and already one squadron has been equipped with machines of this type. Whether they will continue to be used for torpedo firing—for which they were designed—seems doubtful, but they are equally suitable for dropping bombs, mines or depth charges.

Pending the coming into service of the Fairey "Gannets" this year, the Navy is relying mainly on United States aircraft—two squadrons of "Avengers" and one of "Skyraiders"—for anti-submarine work. The "Gannet," which first flew in 1949, is a three-seater aircraft powered by a "Double Mamba" and has a long cruising range. Both the "Avenger" and "Skyraider" are piston engine machines, but high speed is not essential for anti-submarine work. The "Skyraider" is primarily an airborne early warning aircraft with the latest radar devices for detecting "snorting" submarines. A smaller anti-submarine aircraft—the "Seamew"—for operating from converted merchant vessels, and other ships required as convoy escort carriers, has now also been ordered by the Admiralty. Designed by Short Brothers and Harland, Ltd., the prototype, powered by a "Mamba" airscrew turbine, flew last year. It is a comparatively cheap machine, capable of being produced quickly in large numbers to supplement the helicopter for trade protection duties. Three kinds of helicopter are now in use by the Navy, of which the main operational type is the Westland-Sikorsky "S55." A squadron of these machines is now operating in Malaya. The helicopter is, in fact, destined to play an increasingly important role in naval warfare, particularly for anti-submarine work, mine clearance and amphibious operations. An asdic installation lowered into the sea from a hovering helicopter detects a submarine in the same way as when it is installed in a surface ship, and the helicopter then passes the information obtained to a ship in the vicinity. A helicopter, moreover, can be carried and land on a platform built up on the deck of an average-size merchant ship for use as a short-range anti-submarine patrol, thus reducing the number of carriers required as convoy escorts.

The Fleet Air Arm has also nineteen second line squadrons and ten R.N.V.R. squadrons. The former are used for the training of pilots and observers and for carrying out service trials of new aircraft and equipment. The ten R.N.V.R. squadrons are equipped with piston engine machines, but their pilots are all keen to put in flying practice and provide a most valuable addition to the Fleet Air Arm.

**Fig. 7—Steam Catapult as Fitted in H.M.S. "Perseus" for Demonstration in U.S.A.**

### Dockyards and Maintenance

With the Navy Estimates at £364,000,000—£5,750,000 less than last year, in spite of rising costs—it has been necessary to slow up work on new construction, modernisation and conversion, and to draw on existing stocks of oil fuel, mines and ammunition instead of building up reserves. The Royal Dockyards have, however, been kept fully employed. In July, as an experiment, a civilian with dockyard experience was appointed to Chatham Dockyard as Deputy Superintendent (Industrial). His duties are to co-ordinate requirements for yard development and for industrial and labour staff and, in consultation with departmental managers, to prepare the annual sketch estimates for the yard. The appointment results from the conclusions and recommendations in the report of the Select Committee presented over two years ago. The Committee suggested that naval officers could not be expected to possess the knowledge of industrial and commercial management essential for the effective control of the dockyards, and recommended the appointment in each yard of a general manager and a personnel officer directly responsible to him. The Admiralty felt that a personnel officer would not be conversant with the technical work of each individual department and agreed only to appoint a Deputy Superintendent (Industrial) in one dockyard as a trial measure. There is, it must be said, good reason for the Admiralty to hesitate before introducing far-reaching innovations of this kind. The Royal Dockyards are not shipbuilding yards, but in serving the fleet perform work of all kinds. They are, in fact, an agglomeration of different branches and trades, unique in structure and unlike anything else in civilian industry. Moreover, the strongest critics of the existing structure of management admit that the work of the Royal Dockyards since the war has been of the highest order.

Several ships, including a ferry or maintenance carrier, and a number of ocean minesweepers previously earmarked for disposal have been refitted for the reserve. The refitting of these vessels, at a fraction of the cost of building new ships, constitutes an appreciable strengthening of the reserve fleet. The policy of removing reserve fleet ships from the upper reaches of naval harbours to commercial ports continues and over 100 are now berthed at Cardiff, West Hartlepool and other ports. They include destroyers, frigates, minesweepers, and landing craft. Considerable economy in money and naval personnel is effected as the vessels are dehumidified before removal and require only a few civilians to look after the hull and paintwork. The acceptance and maintaining ready for service in emergency of the large number of wooden coastal and inshore minesweepers now completing has made it essential to establish another base for small craft to supplement H.M.S. "Hornet," the existing Coastal Forces base at Gosport. H.M.S. "Diligence" was accordingly commissioned in March for the equipping, commissioning trials and maintenance of coastal and inshore minesweepers and as a reserve base for fast patrol craft. H.M.S. "Diligence" is on the site of the former B.O.A.C. flying boat base, on the western shore of Southampton Water. The two large hangars house the workshops and stores and provide storage for a number of land-cradled fast patrol boats. Accommodation for nine minesweepers is provided alongside the pier. Trots of buoys have been laid out for the berthing of a large number of small craft. The new base will provide steaming crews to take the vessels from the building yards, carry out the necessary trials and maintain those that are placed in reserve. The personnel will be accommodated in a hutted encampment.

New classes of both large and small tankers—Fig. 6—are now under construction. The former are fast vessels with a loaded displacement of 26,000 tons and a cargo capacity of 15,000 tons. They will reinforce existing Royal Fleet Auxiliary tankers, which form the core of the potential mobile replenishment support groups of the Royal Navy. The technique of fuelling at sea, pioneered by the Royal Navy in 1906, has been developed to such a degree that the United States Sixth Fleet in the Mediter-

ranean is supplied almost exclusively by this method. It is of interest to note in this connection that during the Korean operations a British tanker began fuelling a Canadian destroyer under way 105 seconds after the first pilot line had been passed between the two ships. The maintenance carriers H.M.S. "Unicorn," "Perseus" and "Pioneer" have now been redesignated as ferry carriers. The function of these ships is to transport air squadrons, including men and aircraft, to and from operational carriers. The Admiralty has also announced that, consequent on the naming of the Royal Yacht "H.M. Yacht Britannia," the title and name of the Royal Naval College, Dartmouth, have been changed. The college is now to be known as the Britannia Royal Naval College, Dartmouth, and bears the ship's name, H.M.S. "Dartmouth," instead of H.M.S. "Britannia," as formerly.

A new test house for naval gas turbines has recently been completed at the National Gas Turbine Establishment, Farnborough, and also a large frame for testing full-scale structures of ships—the only one of its kind in the world—which is housed at the Naval Construction Research Establishment, Dunfermline. Testing equipment hitherto available to naval architects and structural engineers, has been capable only of testing small-scale models, but it is only possible fully and correctly to assess behaviour from experiments on full-scale structures.

### Research and Development

The guided missiles now being developed for firing from the ground, from ships and from aircraft are likely to have a profound effect on all fields of naval warfare, though recent official statements appear to have been somewhat optimistic regarding the progress already achieved. There is, however, good reason to believe that ten years hence the piloted bomber will find it almost impossible to avoid destruction by anti-aircraft guided missiles. This prospect would be more encouraging were it not for the concurrent development of the guided bombardment rocket, which has reached an advanced stage in the United States—and of the use of atomic explosives in conventional missiles. We may, in fact, anticipate missiles which will no longer fall on us in the form of bombs from overhead, but which will be launched from ships, submarines and bombers at ranges up to 500 miles from their target. Broadly speaking, this should be to the advantage of nations with sea power, which possess ships of battleship size to carry a worthwhile number of them. For they will necessarily be large missiles because of the fuel required to give the range and/or because of the atomic explosive in the warhead of the rocket. In this connection it may be assumed that the Americans would not have produced an 11in shell for tactical purposes in the field if the shaped charges or other appliances required for detonating fissile material could have been put into a smaller container. The battleship, in fact, looks like having a new lease of life, not only as a strategical bombardment vessel, but to carry the armour required as a defence against guided missiles—or against "near misses"—in the event of fissile material ultimately being in plentiful supply and used against ship targets.

These impending revolutionary developments have not, however, resulted in the neglect to improve present-day weapons and equipment, and it is very satisfactory that most of the recent improvements have originated in this country. The production of the multi-barrelled mortar, which, in one compact equipment, detects, locates and fires a pattern of underwater bombs at a submerged submarine, was followed by the steam-operated catapult—also a British invention—which can launch fast jet aircraft across wind and even from a ship at anchor. The illustration Fig. 7 shows a steam catapult as temporarily fitted to H.M.S. "Perseus" for demonstration in the United States. Apart from the tactical advantages given by this new catapult, the conventional pneumatic wire purchase type had reached its practical limit and left no margin for still heavier aircraft in the future. A more recent and no less important development is the extension of the flying deck, designed by the Fleet Air Arm and the Ministry of Supply and since adopted in both British and United States carriers. Briefly, it involves modifying the conventional shape of the flight deck so that aircraft can fly on at an angle of from 8 deg. to 10 deg. to port relative to the ship's fore and aft line. If an aircraft is not halted by the usual method of hooking on to one of the arrester wires, it can fly off again over the side of the flight deck without altering course. This eliminates the use of crash barriers—unless an aircraft signals that it is damaged and must crash land—and the risk to men and aircraft parked in the forward area of the ship. A further advantage is that the arresting area can overlap the parking area amidships. In this way the angled layout has the effect of increasing the length of the carrier by 40 per cent and consequently the speed of operations. The new type of deck has already been fitted in the U.S. carrier "Antietam"—Fig. 8—and is now being installed in the improved light fleet carrier "Hermes," completing at Vickers, and in the fleet carrier "Victorious," now being reconstructed and modernised.

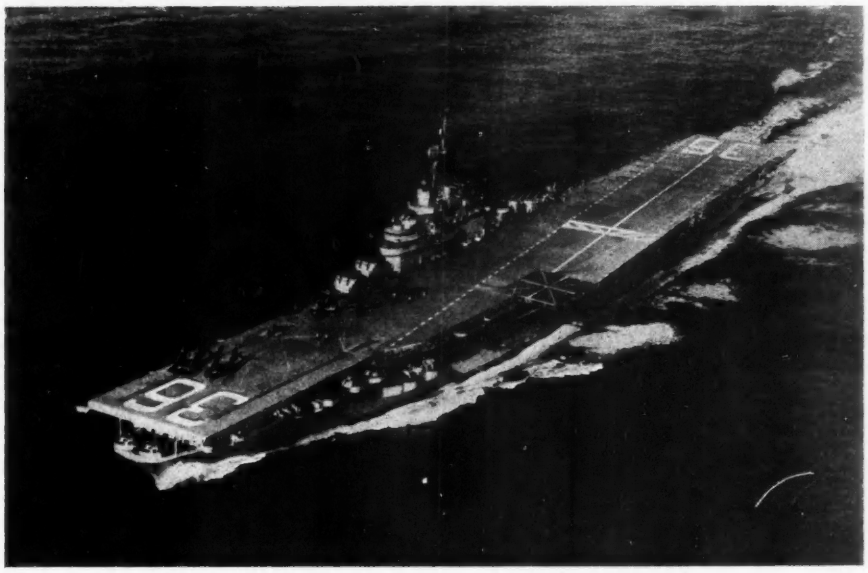


Fig. 8—U.S. Fleet Carrier "Antietam," of 27,100 Tons, Fitted with Angled Deck

The development of the underwater vessel from a submersible to a true submarine—a vessel which habitually navigates submerged—should be fully achieved by the end of this year, when it is anticipated that the U.S. submarine "Nautilus," which has an atomic power plant, will be commissioned for service. Concurrently, submarine crews are being trained to exploit these developments by making long voyages submerged, and last year H.M.S. "Andrew" made a passage of 2500 miles across the Atlantic wholly submerged. The U.S. Navy is also developing a new type of midget submarine, about 40ft in length, with a submerged speed of 12 knots. Successful trials have been carried out with a new mark buoy for release from submarines. Made of aluminium, it is fitted with a flashing light, automatically switched on when the buoy is released, and with an automatic radio transmitter for sending out distress signals. The flashing light has a range of 3500 yards in clear weather and lasts for about fifty-two hours. The upper surfaces of the buoy are painted with a special composition, giving a high daylight visibility range, and the top of the crown contains twenty-four reflecting road studs. A red nylon flag is carried on a mast. The First Lord also announced recently that the Royal Navy now has a submarine rescue ship, as used in the United States Navy for rescuing crews from sunken submarines. The ship is fitted with a chamber which can be lowered down to the submarine and clamped to an escape hatch, thus enabling the trapped men to enter it and be brought safely to the surface from any depth to which the modern submarine is able to dive. Another new development announced by the Admiralty is the use of plastic material for small boats, which is giving promising results. It is hoped that plastic boats will be free of shipworm in tropical waters and that the trouble due to rot may be avoided. Developments in marine gas turbines have already been fully described in this journal. When visiting the new test house for naval gas turbines at Farnborough in March, the Controller of the Navy said that turbines will be found in all classes of ships in some form or another. Smaller ships will have gas turbine propulsion, and aircraft carriers, cruisers, destroyers and frigates are likely to be fitted with gas turbines as boost sets for use when the full power for which the ship is designed is required. Other forms of power for propulsion will provide for the range of speed below the top fifth of power.

### Personnel

The current year's Estimates provide for a total personnel of 151,000, including the women's services. Recruiting continues to be satisfactory and there has been a marked improvement in the number of men re-engaging for pension as the result of the pay and pension increases and the opportunities now afforded for chief and petty officers to serve

for thirty-two years. As with the other Fighting Services, however, there is still a shortage of skilled tradesmen—a shortage which is likely to continue in view of the competition from the armament industry. More serious is the shortage of officers of the right type. Up to 270 entries are required annually, and since 1948, when the age of candidates for Dartmouth was raised from thirteen and a half to sixteen, suitable applicants have not been coming forward in sufficient numbers, either for Dartmouth or for the Special, or " Public School " seventeen and a half year age entry. A special committee appointed by the First Lord to review the whole question of cadet entries recommended in a report presented last May, the continuation of the Special seventeen and a half year age entry, a reduction by half of the entry at sixteen years and the introduction of an additional entry at thirteen years of age. After consultation with the educational authorities throughout the country the Admiralty has now decided that as from October, 1954, all cadets of the permanent entry into the Royal Navy are to join in a single age group at the age of between seventeen and a half and nineteen years.

Last year the pensions for officers' widows, which had remained unchanged for 100 years, were substantially increased and also, for the first time, pensions were introduced for the widows of long-service other ranks. But the Government has not yet yielded to pressure from members of Parliament of all parties to restore the 9½ per cent cut deducted from the pensions of some 170 naval officers who retired on the 1919 rates and have not had their pensions increased by war service in World War II. A further proposal to give all retired officers the benefit of the new pension code introduced in 1950 is still less likely to be approved in view of the costs and the repercussions it would have on the pensions of civil servants.

The need for more naval pilots and observers remains urgent and the age of entry for short-service commissions, supplementing volunteers from permanent service officers, has recently been increased from twenty-four to twenty-six. Short-service officers serve for eight years on the active list and seven years on the emergency list. Twenty per cent are offered permanent commissions, the remainder retire with a gratuity of £1500 after eight years' service. The year 1953 marked the fiftieth anniversary of the formation of the Royal Naval Volunteer Reserve, which now has a strength of 12,250 officers and men, organised in twelve divisions, four air divisions and one independent air squadron. The R.N.V.R. rendered invaluable service in both world wars and no less than 80 per cent of the officers serving in the Navy in World War II held R.N.V.R. commissions—48,000 in all. More opportunities are now given to this force for sea training in R.N. ships, and in 1953 200 R.N.V.R. officers and men spent a month in the ferry carrier " Perseus " during her trip to the U.S.A. to demonstrate the steam-operated catapult. On another occasion more than half the ship's company of a battle class destroyer on a trip to the Baltic consisted of R.N.V.R. officers and men who assisted in carrying out the work of the ship, in addition to receiving practical training in seamanship and gunnery. Formerly the crews of merchant ships requisitioned by the Royal Navy in war continued to serve under engagements known as " T.124 and variant " agreements. This scheme has now been discontinued and requisitioned ships will in future be manned from the Royal Navy and its reserve. With the concurrence of the shipping industry, a scheme has been introduced to improve liaison between the Royal and Merchant Navies. Up to date some thirty-five R.N. lieutenant commanders and lieutenants have been attached for short periods to merchant ships. They signed on as supernumerary deck officers for a nominal sum and in all respects became members of the ship's company.

After refitting at Devonport, the aircraft carrier " Triumph " has now relieved the old cruiser " Devonshire " as the training ship for naval cadets. On her first training cruise, recently completed, she had 212 cadets on board, including sixty from the Commonwealth. The Royal Yacht Service is now to be revived and the new Royal Yacht will be commissioned early this year from men of this service. Long-service ratings will be permitted to volunteer for the Royal Yacht Service, provided they have still three years of their current engagement to run.

### Exercises and Operations

During the Korean campaign seventy-six warships of the Commonwealth Navies and of the Royal Fleet Auxiliary Service served in Korean waters for varying periods. They were mainly employed in controlling sea communications on the west coast of Korea and in giving seaborne air and gun support to the left flank of the ground forces. Twenty-three thousand 6in and 148,000 rounds of 4·7in or 4in shells were fired by H.M. ships in bombardments and 15,200 bombs of various weights were dropped. In all, the casualties suffered by the Royal Navy and Royal Marines were fifty-seven killed (including twenty-two pilots), two died of wounds, ten missing, seventy-five wounded, and twenty-eight prisoners of war.

In addition to the usual fleet and squadron exercises and cruises throughout the year, ships of the Royal Navy have taken part in three large-scale N.A.T.O. exercises—two in the Mediterranean, exercises " Rendezvous " and " Weldfast," and the third, exercise " Mariner " in the Eastern Atlantic, Channel and North Sea. While special attention was paid in these exercises to particular naval problems, such as the protection of sea communications and naval control of shipping, their main object was to practise on a large scale communications and co-operation between the forces of the various N.A.T.O. nations which would operate together in any particular theatre of war. Exercise " Weldfast " was also designed to test and strengthen the readiness of land, sea and air forces to operate in the defence of S.H.A.P.E.'s Southern Europe and Mediterranean Command area. Greek, Italian, Turkish, United States and British forces took part. The results clearly demonstrated the value of the many preliminary exercises on a smaller scale held since the formation of N.A.T.O. Ships of the Indian and Royal Pakistan Navies also carried out what has become an annual combined exercise in the Indian Ocean. Units of the Royal Ceylon Navy were not available to take part owing to the Coronation Naval Review.

In August the Royal Navy once again played its traditional role of bringing succour and relief to stricken areas in emergency. Ships of the Mediterranean Fleet were quick to take the initiative and proceeded at full speed to the earthquake devastated Ionian Islands of Greece, with doctors, nurses, equipment and stores of all kinds. Visits were paid, as usual, to foreign countries and several Spanish ports were visited by one or more of H.M. ships.

# Labour in 1953

By GERTRUDE WILLIAMS

No. II—( *Concluded from page* 12, *January* 1*st* )

LACK of effective co-ordination between union officials and the rank and file is one of the most serious consequences of the growth in size of the individual union and it is surprising that the unions, who have been acutely aware of the effects of size on the position of the worker in large-scale industry, have not thought of applying the lesson to their own organisation. During the last half-century the increase in the scale of the productive unit has led to an insistent demand by the unions for the creation of a hierarchy of consultative bodies so that workers can take some share in the decisions governing their working conditions. The unions have been quick to realise that in a firm employing thousands of workers, the individual feels inconspicuous and helpless and that to him the management is something so remote that he has no hope that it understands anything of his needs and fears. For years, therefore, they have stressed the need for some channel of communication whereby the management can explain to its employees what it is doing and through which the various grades of worker can have the chance of expressing their views. Yet it has hardly begun to dawn on them that the huge union of to-day is just as much in need of a linked chain of communication as is big business ; and one of the most important tasks confronting modern trade unionism is to evolve some more efficient system than exists at present for a two-way method of constant communication between officials and members.

### Wage Demands

One of the unfortunate results of the fall in the value of money which has taken place since the beginning of the war is the change in the nature of wage demands. A claim for increased wage rates can stem from three separate sources : (i) the workers concerned may be so badly paid that they are unable to maintain themselves on the minimum standard accepted as reasonable by the community ; (ii) the workers, whilst able to live on a tolerable standard, may believe that their grade of skill is not adequately paid relative to other occupations of similar grade, and (iii) inflation may so raise costs of living that a money wage which was satisfactory at one time loses its value unless the money terms are readjusted.

Since the end of the war the rise in prices has been so steep—40 per cent since 1947—that the third factor has played a dominant part in all wage negotiations and has, consequently, usually led to a claim to a flat rate or percentage increase covering workers in all processes and grades included within the scope of the negotiating bodies. This year, however, the rapid advance in prices has been halted. Between November, 1951, and November, 1952, the Index of Retail Prices rose 9 points ; between 1952 and

1953 it rose only two points. Yet despite this, demands have continued to be made for a general increase in mining, engineering, railways, retail distribution, catering and many other industries. Amongst workers in the lowest income groups a rise of even two points may be a reasonable basis for a claim, particularly when, as happened last year, the prices of the main foodstuffs rose more than the average of the Index as a whole. But the fact that a larger quantity of tobacco and of clothing, more household goods and the same volume of food were bought in recent months than in the corresponding period last year is a fair indication that the real wages of workers as a whole have not fallen ; whilst the increase in the numbers of workers employed in the consumption industries—in textiles and clothing, in building and chocolate and confectionery and similar trades—is confirmation of the same fact. In such circumstances the only justifiable claims for increases, apart from those on the lowest rates, are those made on behalf of persons whose skill can be shown to be relatively underpaid.

But trade union officials are handicapped in making these specialised claims by the very strength and size of their organisations. Since the year before the war, the membership of trade unions has risen from 6,000,000 to 9,500,000, and the number of unions has fallen from over 1000 to under 700. The principal unions are now much bigger than they were and they include within their boundaries a great variety of workers of different grades of skill and different interests. To push forward the claims of one group without making similar claims on behalf of others is likely to lead to internal friction, and a flat rate increase is the easiest way out.

Just before Christmas one of three railway unions involved, the N.U.R. refused to accept the award of an increase of 4s. a week made by the Railway Staff National Tribunal in response to a claim on the part of the union for a 15 per cent rise ; and gave notice of a strike. The other two unions involved accepted, but only on the understanding that the whole railway wage structure would subsequently be examined. Neither the claim nor the award could be justified on the basis of a change in the value of money—the only factor that could be considered common to all grades—for the rise of two points in the Index means that prices have risen only 1½ per cent since last year and even 4s. represents a 3 per cent rise in the lowest railway wages. Not only are such general increases without any rational basis, but they disturb the wage structure even more than has already been done.

This is not to say that the railwaymen have no cause for complaint ; the contrary is the case. At one time their comparatively low earnings were compensated by their regularity and by their security of tenure ; nowadays in a world of full employment this is no longer exceptional, and the railwaymen earn less than workers of comparable skill and responsibility and have no special advantage to offset this. But this cannot be righted by a general increase covering all grades without any consideration of the work done and the skill or experience required for it. One of the most urgent needs now is for a thorough overhaul of the wage structures—not only in the railway industry but in many others—so that wage differentials can bear some relation to differences in skill and economic importance. The agreement ultimately reached provided for that overhaul. But probably the major factor in gaining its acceptance by the N.U.R. was the promise of a further pay increase early in the New Year over and above the 4s. per week.

### Price Index

A good deal of criticism is constantly directed towards the composition of the Price Index, which figures so largely in wage claims now and, in fact, the official title—the Interim Retail Price Index—is an indication that the present one was intended only as a stopgap. The weighting of the Index is based on the results of the official inquiry into the budgets of persons earning less than £250 a year, which was made in 1937–38. Since then some alterations have been made to bring it more into line with what is known of the current pattern of expenditure, such as, for example, reducing the weighting of the rent factor, which, as the combined result of rent restriction and higher earnings now represents a much smaller proportion of working-class spending than it did. But by and large, the Index now in use reflects the way of life of the mass of population before the war and there is no doubt that far-reaching changes have taken place in the relative importance of different elements in budgets.

Moreover, the category on whose budgets the Index is based included at that time 90 per cent of all those in receipt of any income at all, but even if, at a rough guess, we put the value of £250 then as £500 to-day, it would no longer be anything like as comprehensive nowadays ; for, if the average earnings of all men over the age of twenty-one was £9 6s. 11d. last April it is obvious that a considerable proportion of wage-earners must have been receiving an appreciable amount over this figure.

The new Price Index, which is now in preparation, is intended to be much wider in scope and will include samples from income ranges varying from £150 to £1000 a year. It is thought that this will cover practically all wage-earners and most small and medium salary earners, but, so as to ensure the adequacy of these limits, the inquiry is covering a sample of all classes of household whatever their income, and the final decision on the precise limits to be adopted for the Index will not be made until the results of the inquiry are known.

### An Ageing Population

For some years now the problem of the changing age structure of the population has been a matter of concern—more, it must be admitted, to those whose work or interest it is to study these sociological matters than to the general community—and the Government has appointed a committee to consider this question and advise on any appropriate action that may be taken. This committee—the National Advisory Committee on the Employment of Older Men and Women—recently issued its first report and in it brought together a good deal of valuable material. Put briefly, the trouble is that the community is getting increasingly middle-aged and elderly and will continue to do so at an accelerated pace.

Towards the end of last century the birth rate began to go down so that in each decade a smaller number of young people was added to the population. At the same time, as a result of medical knowledge, better public health and higher standards of living the expectation of life has increased. This means that not only were more people being born fifty, sixty and seventy years ago than a couple of decades later, but also that a larger proportion of this larger number remained, and remain, alive to reach old age. Consequently, the proportions of the young to the old are constantly decreasing. At the beginning of the century there were ten people over the present minimum pensionable ages (sixty-five for men and sixty for women) for every 100 younger persons of working age i.e. school-leaving age to minimum pensionable ages) ; now there are twenty and in less than a generation there will be thirty. Before another twenty-five years have passed one in every five of the population will be over the pensionable age.

Nor is this all ; the proportion of the older in the working age groups is also rising. In ten years' time the population between the ages of twenty and forty will be 7 per cent less than it is now and that between fifty and sixty will be 17 per cent more. We have to rely on the younger age groups for the Armed Forces and the Police and for all those occupations where physical vigour and endurance are the prime requisites. This is work that cannot be done by older men and it is obvious, therefore, that those remaining for general industrial and commercial occupations will be even more heavily weighted on the side of middle age.

Some people think that these prognostications are unduly pessimistic. They point to the rise in the birth rate that took place towards the end of the war years and which has caused the high increase in the numbers of school children at the present time. After the lean years, they argue, will come the fat ones when these school children finish their schooling and swell the recruits to the industrial army. Unfortunately this optimism has no justification. War generally has the effect of increasing the number of births ; people marry younger and begin their families earlier than they usually would because of the separation that must be faced. The peak of our birth rate was reached in 1947 and has since gone down ; and as far as it is possible to tell at present it appears that the larger number of children born did not presage any increase in the size of the average family. Young parents had their children earlier in their married life but do not seem to be having a larger total number.

### Employment of the Elderly

It is evident then that unless elderly people stay on in employment the working section of the population will become progressively smaller in relation to the numbers dependent on their productivity. Unfortunately, during the twenty years between the two wars when unemployment was the outstanding social problem, older people were urged to retire and leave jobs for others and most people got the idea firmly fixed in their minds that a man ought to retire at sixty-five and a woman at sixty. Even the name of the benefits provided by law for those no longer in work—old-age pensions—emphasised this attitude ; and although the National Insurance Act substituted the term " retirement pensions " partly in order to change this attitude, it is by no means easy to alter an idea which has become embedded in the social consciousness. At present, of the 2,000,000 men and women in the five-year-age group immediately following the minimum pensionable ages, only 400,000 men are occupied and a very much smaller number of women.

Yet there is no doubt that a large proportion of the unoccupied are physically and mentally capable of doing work of great value and, indeed, that they would be happier and healthier if they were doing it. Recent investigations have shown that the main difficulty with which older workers have to contend is the need for speed, and

OIL REFINERIES OF 1953




Fig. 2—Coryton Refinery, Propane Deasphalting Unit



Fig. 4—Fawley Refinery, Propane Dewaxing Unit



Fig. 1—Grangemouth Refinery



Fig. 3—Stanlow Refinery, Butane and Propane Storage Tanks

that jobs requiring even moderately heavy muscular effort can be done successfully provided the tempo is not too fast. The older person is, on the other hand, at some positive advantage in work demanding accuracy and attention to detail and there is, therefore, a considerable field for transference from work where speed is essential to other types where precision is more important.

Nor is this transference in itself an obstacle for it seems that older persons are in general more adaptable and teachable than is commonly thought. There are two chief hurdles to overcome : the first is the diffidence and conservatism of older people who hesitate to embark on new activities and often need to be persuaded that " life begins at fifty," the second is the slowness of recognition on the part of managements that changes in recruitment policy and employment practice are essential. Among many manual occupations recruitment policy is not a serious handicap for workers are taken on at any age if they seem capable of doing the job, particularly since the Industrial Injuries Act removed the liability for accident compensation from the individual employer. But it is rare to find any firm deliberately attempting to find out the types of jobs that can be done well by older workers and reserving these for those who can be transferred from work where the strain is too heavy for the middle-aged and elderly. With regard to clerical, technical and managerial work, on the other hand, it is recruitment policy that mitigates against the older worker. Very often there is an age limit for entry to the job and even where this is not openly stated the older man or woman finds it extremely difficult to change his work after the onset of middle age. Some few firms are honourable exceptions in this respect and reserve certain branches of their work for older people, one or two even keeping some routine branches of their clerical work for those who have retired from other employment. Much more needs to be done along these lines if a larger proportion of the capable elderly are to be retained amongst the ranks of the independent.

There is another side to this problem and one to which the Government Actuary has drawn attention in his annual report. At present the work of 23,250,000—the total at work in any capacity—must support 5,500,000 old people ; but if the practice now common with regard to retirement remains in force there will, in twenty-five years' time, be just about the same number of occupied persons but 8,250,000 older people to be maintained by them. Already the cost of old age and retirement pensions is the heaviest liability on the Insurance Fund ; last year it accounted for 70 per cent of all expenditure and it must soon be very much more burdensome. Yet even so, the size of the pension is not enough to maintain a person who has no other resources without supplementary aid from National Assistance.

When the Beveridge Report was published the provision of a benefit giving basic subsistence as of right in all the chief vicissitudes of life was the main plank in its recommendations and this became the acknowledged principle of the National Insurance Act. Unfortunately, inflation has knocked the bottom out of that. Since 1947 the Price Index has gone up 40 per cent whilst the benefit has been increased by only 23 per cent and we can no longer pretend that we are providing a statutory right to a basic standard of living for all those who are unable, for one reason or another, to earn for themselves. The first five-year operation of the Act is now complete and this year the Government is under the statutory obligation to review the scheme. It is difficult to see what it can propose. The maintenance of a minimum standard for all members of the community as a civic right is a noble ideal and should not be lightly abandoned ; yet the increasing productivity on which it must ultimately be based is not something that can come into existence by Act of Parliament. It depends on the number of people at work and the amount of work they do.

# Oil Refineries of 1953

DURING 1953 progress was made towards the completion of the scheme to build refineries at home rather than in or near the countries which supply the crude oil. This pattern of development, dictated by economic circumstances of the post-war years and designed to save hard currency and reduce the dollar content of the oil, has seen a large expansion of production at home. At a number of existing refineries new units were added and old ones adapted in 1953, while several new refineries were planned and built. The latest to come on stream are the Kent refinery of the Anglo-Iranian Oil Company, Ltd., and the Coryton refinery of the Vacuum Oil Company, Ltd., both of which began operating last year.

With eight major refineries and a number of smaller units on stream the refining of crude oil is a major industry and the effect of the policy of the oil companies to build refineries in Great Britain has been reflected in the rapid rise in the annual rate of refining capacity. This has increased from 2,500,000 tons immediately after the war to nearly 28,000,000 tons in 1953, a figure which is about 5,500,000 tons in excess of the 1952 total.

The overall world demand for oil products continued to increase and the estimated amount for 1953 was 74,758,000 metric tons, which compares with 69,402,000 metric tons proved in 1952. Production of crude oil from the various oil-fields expanded and more than made good the loss of oil from Iran. In keeping with the increased production and consumption was the demand for oil tanker tonnage and the latest figures available showed that 298 vessels of 3,389,115 tons were under construction, representing about 56·5 per cent of the total amount of tonnage building in the world. Of the total world tonnage afloat, oil tankers at about 20,000,000 gross tons represented about 22 per cent.

Despite extensive flooding earlier in the month, the distillation unit at the Kent oil refinery of the Anglo-Iranian Oil Company, Ltd., on the Isle of Grain, which was generally described in THE ENGINEER of May 16, 1952, was commissioned last February and the first cargo left by ship early in March. The coming on stream of the distillation unit, a photograph of which is reproduced on Plate 4, marked the completion of the first stage of the 4,000,000 tons per annum refinery. Also commissioned in February were the gasoline stabiliser, the copper chloride sweetener and a solutiser unit.

During the year work proceeded on phase two of the construction scheme, which includes the first of two 17,000 barrels per stream-day vacuum units, a catalytic cracking unit, and a sulphur dioxide extraction plant. The catalytic cracking plant of 10,000 barrels per stream-day capacity, and the vacuum unit, together with several of the smaller treatment plants, were commissioned in October, while the sulphur dioxide plant was completed in December. These new units required an additional supply of cooling water above that already provided and a pump-house was built, on the foreshore of the River Medway and adjacent to the jetties, to house three pumps having a total capacity of 2,000,000 gallons per hour.

Meanwhile, phase three of the plan made progress and by the end of the year work was well advanced on the second vacuum unit, the lubricating oil plants, and the

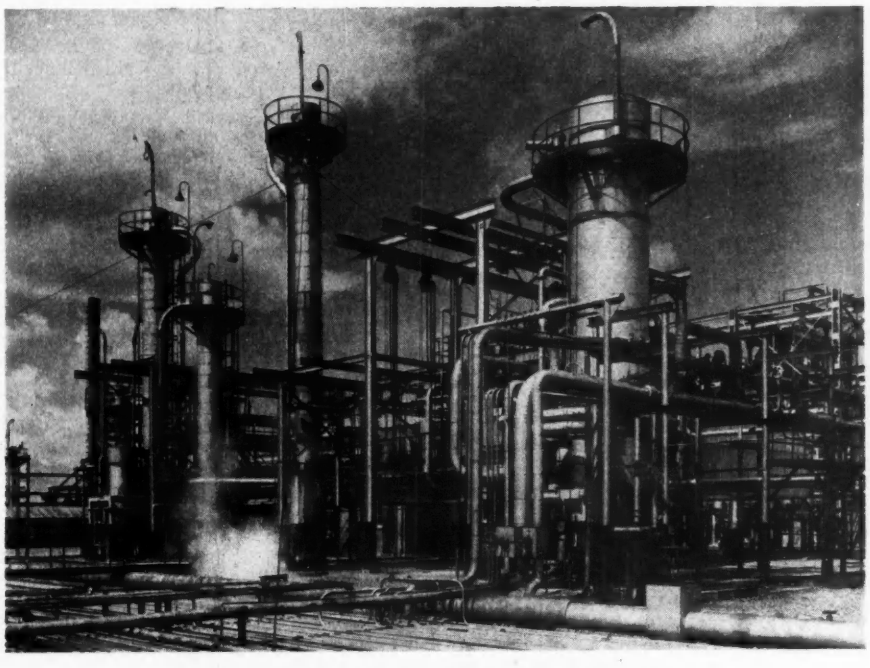


Fig. 5—Stanlow Refinery Chemical Plant—M.I.B.K. Unit

lubricating oil packaging and blending plant. Work on the process units was practically complete; these units include a propane deasphalting plant, a hot oil belt heater, a furfural extraction plant, an M.E.K. dewaxing unit and a clay contacting unit. It is expected that this third stage will be completed early this year with the commissioning of the packaging and blending plant, together with a new jetty, at present under construction, for the shipment of lubricating oils. The lubricating oil section of the refinery is planned to have an annual capacity of 140,000 tons. A start was made late in the year with the fourth stage of the refinery construction plan when the foundation piles for the platformer were driven. This unit, which has a capacity of 6000 barrels per stream-day, will produce a high-grade motor spirit component by a reforming process using a platinum catalyst.

Last year saw the completion of the post-war expansion programme at the Llandarcy refinery of the Anglo-Iranian Oil Company, Ltd., which has raised the capacity of the refinery from 360,000 tons to more than 4,000,000 tons per annum. At the beginning of the year the 10,000 barrels per stream-day catalytic cracking unit for the production of high-grade motor spirit was commissioned and some months later a hypochloride sweetener was completed. An important part of the development programme was the new lubricating oil plant, which was completed and which will raise the rate of production of lubricating oils to 115,000 tons a year. Other additional plant which began operations during the year included the furfural extraction and the gas oil heating units, the propane deasphalting plant and the M.E.K. dewaxing unit, while a final lubricating oil plant, a wax treatment unit, was still to be completed. The second and third towers of the cooling water system were completed; both have a base 160ft in diameter, a height of 230ft and a capacity of 900,000 gallons per hour. As an addition to the expansion scheme now almost completed, it is planned to build a 6000 barrels per stream-day platformer, work on the foundations of which was started.

Fig. 1 gives a general view of the Grangemouth refinery, on the Firth of Forth, operated by Scottish Oils, Ltd., at which a 10,000 barrels per stream-day catalytic cracking unit was commissioned to increase the production of high-grade motor spirit. Progress was made with the construction of a 2200 barrels per day catalytic polymerisation unit, which will further augment the production of motor spirit, and to purify the feed stack for the unit a Girbotol plant was under construction. A companion plant under construction was a sulphur extraction unit for the extraction of elemental sulphur. The increased throughput of the refinery made it necessary to raise the capacity of the 57 mile long pipeline, which carries the crude oil from Finnart, from 2·4 million tons a year to 3·5 million tons and to do this, work was started on the installation of an additional pump at Finnart and a pumping station at Balfron.

The refinery expansion plan of the Shell Petroleum Company, Ltd., is complete, but existing units continued to be modified to bring the refineries into line with the latest practice; the company's four refineries, at Stanlow, Shell Haven, Heysham and Ardrossan, have a throughput of more than 9,000,000 tons per annum. Figs. 3 and 5 reproduced herewith illustrate the M.I.B.K. unit and the butane and propane storage tanks at the Stanlow refinery. At this refinery a platformer unit for the production of aviation gasoline was completed, at a cost of £3,500,000, and brought into operation and work proceeded on a hydro-desulphurisation unit which is the first of its kind. Hydro-desulphurisation, up to the present, has always been effected in the vapour phase, but the new unit is designed to perform the same function in the "trickle" phase where the oil flows in a thin film over a catalyst in the presence of hydrogen under pressure. The production of chemicals increased in volume and range, particularly with regard to chemical solvents, and preparations were put in hand to widen the range of detergents manufactured. About 11,000 tons of high purity sulphur were recovered from the refinery gases and progress was made with the construction of a plant designed to recover sulphuric acid from waste sludges. Although practically all the new development work was concentrated at Stanlow, a number of major modifications to some of the treatment plants were started at Shell Haven and a partial redesign of the solvent extraction unit was completed. This consisted of the installation of a rotating disc contactor, a new principle of counter-current extraction, to increase the efficiency of the lubricating oil plants.

It was expected that the Fawley refinery of the Esso Petroleum Company, Ltd., which is the largest single refinery in Great Britain, would attain a capacity of more than 6,500,000 tons in 1953. Since the refinery came on stream in 1951 work has proceeded with the second phase of the expansion programme which was completed last year with the commissioning of three major units. A hydro-desulphurisation plant for producing a premium grade tractor fuel by reducing the sulphur content was completed in April. This reduction in sulphur content is achieved by passing the fuel, mixed with hydrogen, over a bed of catalyst and the resulting stream of hydrogen sulphide is fed to a sulphur recovery plant. This unit, shown in Fig. 6, was finished in June; it is supplied with the hydrogen sulphide produced in various refinery processes and utilises the high sulphur content of Middle East crude oil to produce 40 tons a day, or about 14,000 tons per annum, of 99·5 per cent pure rock sulphur. The third unit completed was a lubricating oils plant, which consists of four units: a propane deasphalting plant, which washes the lubricating oil and removes asphalt; a propane dewaxing plant, which removes wax by crystallising and filtering and can be seen in Fig. 4; a phenol extraction plant, which removes compounds having poor lubricating qualities, and a clay contacting plant for improving the colour of the finished product.

Since January of last year, when No. 1 boiler of the power plant was lit up, the Coryton refinery (Plate 4) of the Vacuum Oil Company, Ltd., was gradually brought into production as successive units were completed and came on stream. The Thermofor catalytic cracking plant, which uses the air-lift principle to return the regenerated catalyst to the reaction chamber, made considerable progress. The furfural treating unit, which removes impurities from the lubricating oil stocks to ensure a high viscosity index in the finished product, was ready in August and was followed into operation by the propane deasphalting plant, which we illustrate, Fig. 2, and the M.E.K. dewaxing unit. By the end of the year the complete flow was established when the Thermofor continuous percolation unit, which uses clay to remove undesirable coloured matter and is the final stage in the manufacture of lubricating oils, was brought into operation.

Work on the additional plant at the Manchester oil refinery was completed during the year and the new atmospheric fractionating unit, which is capable of separating the cuts within fine limits, operated in conjunction with the existing vacuum unit to raise the throughput of the refinery by 30,000 tons per annum.

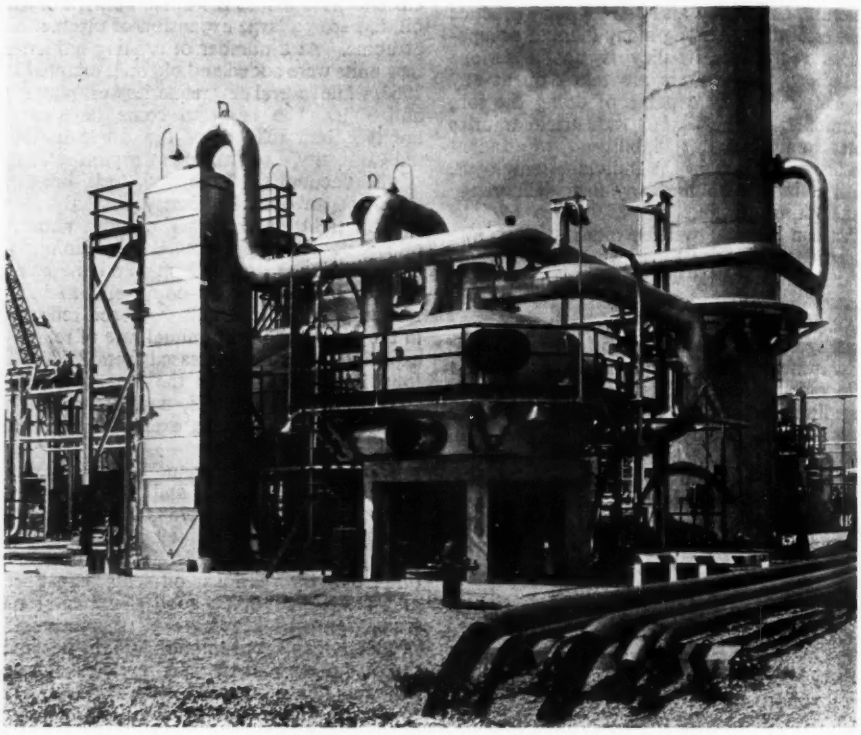


**Fig. 6—Sulphur Recovery Plant at Fawley Refinery**

# BRITISH AIRCRAFT OF 1953



The Vickers "Swift" in Libya



The Handley Page "Victor" Bomber

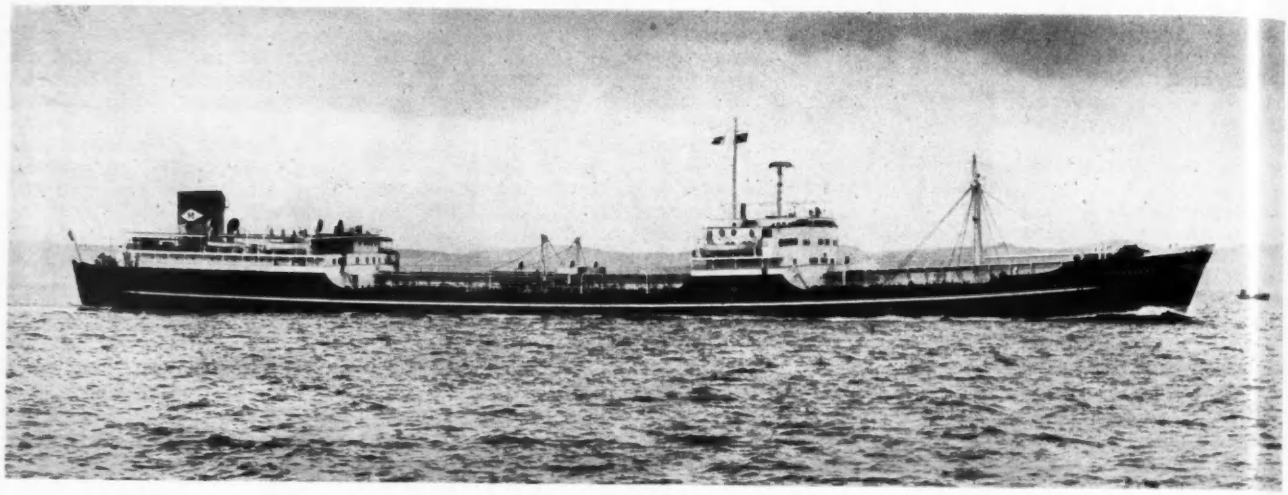


Variable Swept Wing Research Aircraft



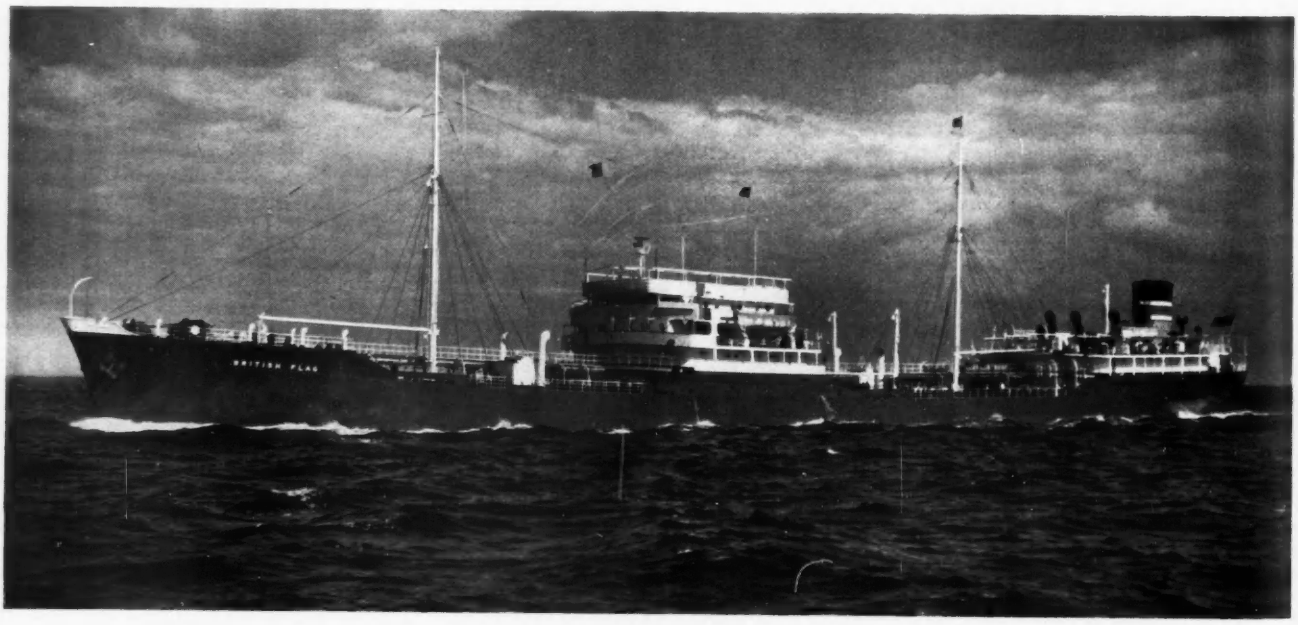
The Short "Sherpa" Isoclinic Wing Tailless Research Aircraft

# OIL TANKERS OF 1953



Motor Vessel "Polartank"

Steamship "Atlantic Baroness"



Motor Vessel "British Flag"

# Aeronautics in 1953

No. II—(*Concluded from page 19, January 1st*)

### Some S.B.A.C. Statistics

By the end of the year the Society of British Aircraft Constructors was able to announce that the aircraft industry's exports had reached almost £64,000,000. This value exceeds the whole of the exports for 1952 by £20,000,000. Since 1950 aviation exports have almost doubled, and it is expected will shortly reach the £100,000,000 mark.

The labour force of the industry continued to expand during the year at the rate of about 2000 per month, the largest monthly increase being that recorded in September of 3500. It was stated by the Society that, at the end of September, the number of people engaged on the manufacture of airframes, engines, undercarriages and propellers then totalled 250,000. This figure, therefore, excludes the very substantial number of people engaged on accessory equipment and on work sub-contracted by the main aircraft companies. Neither does it include the labour force engaged in the guided missile industry.

### Establishment of British Firms in Canada

A considerable expansion in the capacity of the Canadian aircraft industry, and in particular of those companies which are associated with the British industry, was reported during the year.

Altogether there are about forty companies closely associated with parent companies in Great Britain. Five of the Canadian companies are members of the Society of British Aircraft Constructors, which has eleven Commonwealth members altogether. Some details of this expansion are given herewith.

The de Havilland Aircraft Company of Canada, which has been long established for aircraft design and production there, is preparing to move from its old plant at Downsview to a new factory nearby of 600,000 square feet. In Nova Scotia the Fairey Aviation Company of Canada, whose beginnings in Canada are of more recent origin, is building an extension to its factory near Halifax of about 208,000 square feet and provision for a further 160,000 square feet has been planned. The company, Avro Canada, which is now in full production at its Montreal factory with the twin-engined "CF100" all-weather fighter and the "Orenda" turbo-jet engine, has invested 17,500,000 dollars in acquiring with its tools and equipment a Government-owned factory near Toronto, where the "Orenda" is produced.

The latest British company to expand its Canadian interests with a new, large factory near Montreal for the servicing and eventually the production of jet engines is Rolls-Royce, Ltd. The final stage in this programme will be the servicing of "Nene" turbo-jet engines, built in Britain for a Canadian-built trainer. The assembly of components and testing in Canada will follow and, finally, the complete manufacture of engines will be undertaken.

A new factory for the overhaul and repair of engines was opened by Bristol Aeroplane Engines (Western) Company to supplement its factory at Vancouver. The new factory, of 85,000 square feet, near Montreal, handles about seventy-five engines a month, giving the Bristol organisation in Canada a total capacity of some 130–140 engines a month.

There was opened by Dowty Equipment, of Canada, last November a 60,000 square foot factory at Ajax, Ontario, 20 miles east of Toronto, and another important new accessory factory—the Lucas-Rotax plant—is also in production at Scarborough, near Toronto. It has a floor space of some 120,000 square feet and is to employ about 1500 people in the production of items such as turbo-starters, electric starters, magneto parts, &c. There is also a small but well-equipped factory operated by Sir George Godfrey and Partners in Quebec, producing pressurisation equipment for the latest Canadian-built aircraft. Finally, there is Field Aviation at Oshawa, Ontario, an associate of the Hunting Group of Companies. This organisation is responsible for extensive servicing work on R.C.A.F. aircraft and also for sheet metal and other sub-contracted detail work.

### Production of Gas Turbine Airliners

At home the production programme for the three gas turbine propelled airliners for which the British civil aircraft industry is now primarily committed became more established.

Apart from the expansion within the de Havilland organisation itself to produce the "Comet" series of turbo-jet airliners, Short Brothers and Harland, Ltd., has for some time now been preparing a production line for these aircraft using a similar technique to that of the parent company. Work on the first machine at its Belfast works approaches completion and the company expects that it could reach the production rate of one such machine a week, should the demand arise. More recently it was announced Short Brothers and Harland, Ltd., had entered into a private agreement with the Bristol Aeroplane Company, Ltd., also, to prepare capacity at the Belfast works for the part production of "Britannia" turbo-propeller airliners. The Short Brothers production unit is now one of the largest aircraft factories in Europe, comprising nearly 2,000,000 square feet of floor area. About 250,000 square feet was specially built for "Comet" production. Preparations for the production of the "Britannia" at Filton were also advanced during the year by the vacation of the huge "Brabazon" hangar following the Government decision made on July 20th to scrap the "Brabazon" aircraft. Vickers-Armstrongs, Ltd., besides the expansion of its existing shops, has turned over the Hurn works to "Viscount" production, and capacity is being built up there for planned production of up to 100 aircraft a year. Some of the sub-contractors on the "Viscount" have also acquired new premises.

The biggest of the engine production programmes laid down has been for the Rolls-Royce "Avon," a key engine for both military and commercial work. The opening was reported in The Engineer, November 27th, of a large factory for its manufacture at East Kilbride, Scotland, consisting of four large shops, and there are other factories, also in Scotland, allied to it. There is also Napier's factory for "Avon" production near Liverpool; Bristol's new factory, also in the north, and space turned over to "Avon" production at the Standard motor-car works. The Armstrong Siddeley "Sapphire" is also now in production at another works in the Hawker Siddeley Group.

### Gas Turbine Airliners in Operation

Eighteen different airlines have ordered British gas turbine airliners. They represent twelve different countries in widely separated parts of the world, ranging through Great Britain, Eire, France, the West Indies, Canada, the U.S.A., Venezuela, Japan, India and Iraq in the Northern Hemisphere, and Australia and Brazil south of the Equator. On the route networks of these operators gas turbine airliners will link most of the major cities of the free world.

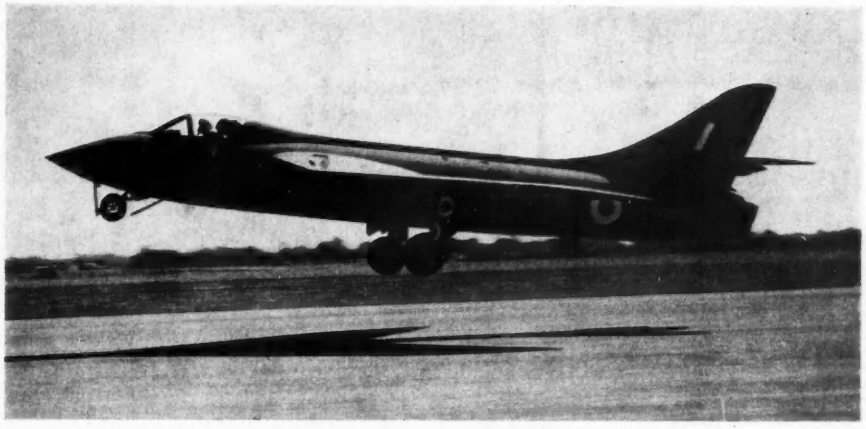


**Fig. 5—"Hunter" Taking Off for Record Attempt**

Altogether 175 aircraft have been ordered—fifty-four "Comets," eighty-four "Viscounts" and thirty-seven "Britannias." The total value of these aircraft is of the order of £66,000,000. The value of spares, which usually equal the value of the aircraft itself during its useful life, are not included in this figure. Apart from these firm orders many other operators have options for British turbo-jet and turbo-propeller aircraft to the value of £100,000,000.

The worth of the "Viscount" to British European Airways is noted in some statistics published last month, covering the first six months of their commercial service. The chief executive, Mr. Masefield, stated that, with an average of seven "Viscounts" in service, B.E.A. flew 45,000,000 passenger miles with them, and earned £1,400,000. Total costs amounted to £1,005,000, including interest on capital giving a profit of £395,000—equal to £64 profit an hour. Over the average stage-distances of B.E.A. flights (240 statute miles) the "Viscount"

has a cost per capacity of ton-mile flown of 39·4d. compared with the average of 42·0d. for all B.E.A.'s operations during the same period.

The ten routes now being flown by B.E.A. with the " Viscount " are as follows: London-Lisbon, London - Rome - Athens - Cyprus/Istanbul, London-Gibraltar, London-Bordeaux - Madrid - Gibraltar, London - Copenhagen-Stockholm, London-Geneva-Milan, London-Zurich-Vienna, London-Frankfurt, London-Belfast, and London-Glasgow.

In most cases the introduction of this new form of air travel had a very welcome effect on B.E.A.'s traffic figures. Four of these routes are highly competitive, yet the upsurge of passenger preference for the " Viscount " was immediate, and has since been sustained at a very high level. On the London-Zurich service, B.E.A.'s share of the total traffic, prior to the introduction of " Viscounts," was running at a summer average of about 25 per cent. In the first month of its use this percentage rose to 36, and by July it had risen to 43 per cent. It has been maintained in the 40's since—a clear gain of 15 per cent on last year's totals. Between London and Geneva, the 1952 summer percentages for B.E.A. were again between 20 and 25 per cent. In May of this year the percentage was 28. In June, with the introduction of the " Viscount," the figure jumped to 53 per cent and has remained in the 50's.

On the Scandinavian route the immediate " Viscount " jump was from 33 to 43 per cent and the average percentage gain since has been 12. On the Istanbul service the " Viscount " preference has been even more clearly marked with an average gain of 18 per cent. During the first month of the London-Lisbon route the passenger load factor was as high as 80·4 per cent, and on the first-class service London-Glasgow the passenger load factor was 86·3 per cent.

A similar influence has been observed by Air France, which operates the " Viscount " on the Paris-Milan-Rome, Paris-London, and Paris-Nice-Rome routes.

The " Comet," now well into its second year of regular commercial service (20,000 flying hours), is being operated by British Overseas Airways Corporation on the following routes: London - Rome - Beirut / Cairo - Khartoum - Entebbe-Livingstone-Johannesburg, London-Rome - Beirut / Cairo - Bahrein - Karachi - (Bombay - Colombo) - Delhi - Calcutta - Rangoon-Bangkok (Singapore)-Manila-Okinawa-Tokyo. Air France is operating it on the Paris-Rome-Cairo/Beirut, and Paris-Casablanca/Algiers routes, and the French Independent operator, Union Aeromaritime de Transport on the Paris-Casablanca-Dakar-Abidjan and on the Paris - Tripoli - Kano - Brazzaville - Johannesburg routes.

Evaluation of the Mark II " Comet " with " Avon " engines has proceeded during the year and it is now about to depart for tropical trials. The production version of this machine is to have slightly modified wing leading edge giving the wing an increased camber. Apart from the improved slow flying characteristics which result from this modification it is stated that the wing cannot be stalled during take-off even with the tail bumper on the ground.

This contingency was one of those examined following the two accidents involving " Comet " aircraft during take-off.

**Fig. 6—The Bristol Type " 173 " Twin-Engined Helicopter**

### Helicopters

All successful craft which are at present classed as helicopters have hitherto been entirely dependent upon one or two motors for both lift and forward propulsion. Most have had only one engine driving a single rotor and an anti-torque rotor at the tail. Examples of these, such as the Westland Sikorsky " S51," which seats three, the Bristol " 171," seating four, and the much smaller " Skeeter " aircraft have been seen in several past flying displays at Farnborough. The usefulness of machines of this size has been amply illustrated in military and agricultural roles, but analysis of their performance for purely civil transport purposes has shown them to be entirely uneconomic. It has been shown that their total cost per passenger-seat-mile exceeds 20d. over stage distances up to 100 miles, for which the helicopter is most suited, and that a capacity of forty to sixty passengers is necessary if the helicopter is to operate competitively with fixed wing aircraft at a rate of about 4/5d. per passenger mile.

To meet this requirement there is growing evidence that the configuration of the helicopter will change quite radically. The Bristol " 173 " Marks I and II, which is admitted to be an interim development machine, seats up to eighteen passengers. It has twin Alvis " Leonides " engines of 550 h.p. disposed at the ends of the fuselage, each driving one rotor in opposite directions. The shafting is arranged so that either engine can drive both rotors and so satisfies the basic civil requirement of being able to sustain flight on one engine. The safety of the machine, nevertheless, still depends on the proper functioning of both rotors and their hub control mechanisms.

However, one very important departure from this logical development which is now gaining favour is the use of stub wings to relieve the rotors of part of the load in forward flight. Apart from the structural and aerodynamic advantages this arrangement bestows on large craft of this kind it also becomes possible to effect some kind of emergency landing, depending on the wing area fitted, should the rotors fail.

A first indication of this trend is provided by the Mark III version of the Bristol " 173," illustrated in Fig. 6, which first flew last year. The stub wings which have been added to this craft make perhaps only a modest contribution to the lift, but they enable the aircraft to travel considerably faster than the earlier versions.

The development of the helicopter in this guise can be very greatly influenced by the gas turbine. It becomes possible, for instance, to mount on the wings propeller turbines giving forward thrust and also supplying compressed air to jet motors mounted at the rotor tips. This is the arrangement chosen for the Fairey " Rotodyne," illustrated herewith (Fig. 7), a prototype of which was ordered by the Ministry of Supply last year. In flight the 100ft rotor auto-rotates, all the power from the wing-mounted Napier

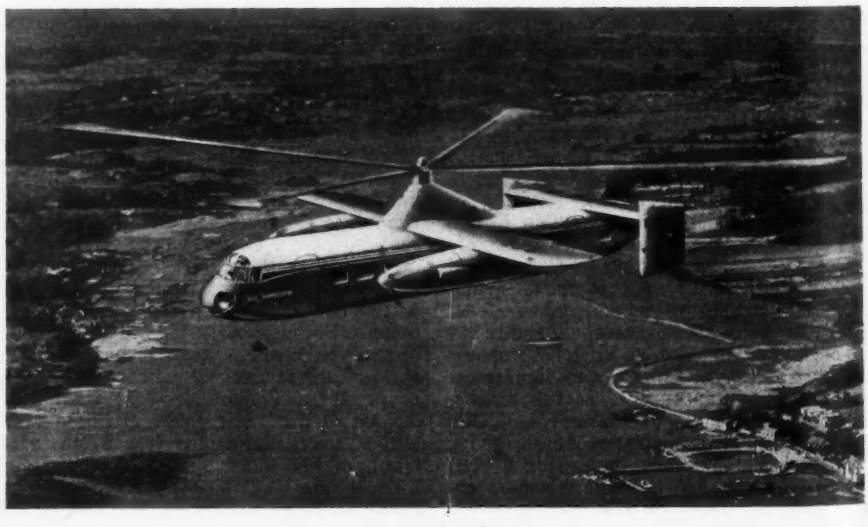


**Fig. 7—The Fairey " Rotodyne "**

"Eland" gas turbines being absorbed by the forward thrust propellers. In this condition the rotor and the wings make about equal contributions to the lift. When vertical flight is required, nearly all the available power from the turbines of the "Eland" engines is used to provide compressed air to the rotor. The capacity of the "Rotodyne" at the prototype stage will be fifty passengers. Two papers which discussed these trends in the design of rotary wing aircraft were read at the Anglo-American Aeronautical Conference last September. In one paper, entitled "Power Plants for Rotary Wing Aircraft," by A. G. Forsyth, of the Fairey Aviation Company, Ltd., this change-over from piston engines to turbines was discussed, the

Fig. 8—The Douglas "X-3" Supersonic Aircraft

major portion of the paper covering experimental work on the development of jet-driven rotors. The application of pulse, ram and pressure jets was fully covered and, in addition, these systems as applied to large aircraft were fully described and illustrated. A description of the "Gyrodyne" and "Rotodyne" schemes was included. Various methods of providing the air supply for pressure jets were shown; a pneumatic system which could be applied to any form of rotor or propeller drive was also included. The concluding paragraphs covered the French helicopters with jet-driven rotors.

The paper by R. H. Miller, of the Kaman Aircraft Corporation, entitled "Some Factors Affecting Helicopter Design and Future Operations," considered the problems encountered with various rotor systems and discussed means of increasing the cruising speed such as the partially unloaded rotor, the rotor with offset flapping hinges, and the supersonic rotor. Various means of rotor propulsion and their relative limitations and advantages were evaluated as a function of range and weight reduction. The problems involved in establishing adequate structural design criteria were briefly discussed, together with the results of recent tests aimed at a better understanding of the harmonic blade loading problem. Finally, the handling qualities of conventional helicopters were analysed and means suggested for providing satisfactory and reliable blind flying characteristics for all weather conditions.

### Military Aircraft

With the advent in previous years of one or more aircraft of different configuration to suit each of the principal military specifications, it was not surprising that no further high-speed aircraft made its first flight last year. All the aircraft concerned in these roles have been previously described on several occasions in THE ENGINEER.

In the fighter role both the "Swift" and "Hunter" interceptors are in quantity production. Their present form probably concludes their own development and that of the basically subsonic aircraft, for it is unlikely that the next family of fighters which will be capable of sustained supersonic flight will bear any resemblance to them. The fighter adopted for the radar interception role, and likewise in quantity production, is the Gloster "Javelin." This has the delta platform and is fitted with two Rolls-Royce "Avon" engines. Both the "Hunter" and the "Swift" made attempts on the world speed record, the "Hunter" aircraft illustrated (Fig. 5) attaining a best average of 727·6 m.p.h. on September 7th and the "Swift" achieving an average of 735·7 m.p.h. later, in more favourable temperature conditions over a site

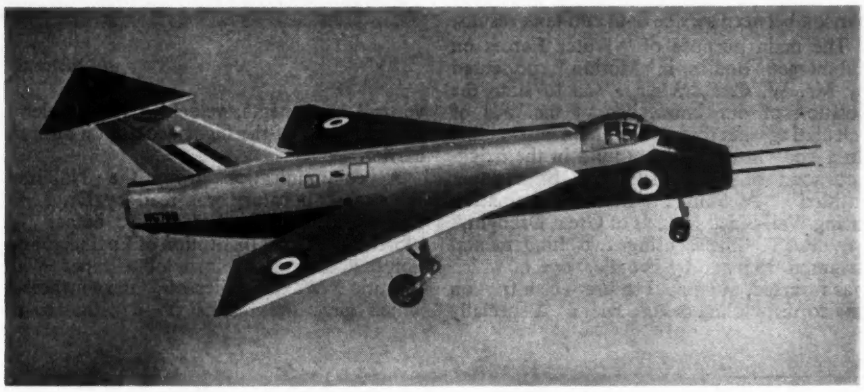


Fig. 9—The Short "SB5" with Sweepback Set at 60 deg.

in the Libyan desert, where our illustration (Plate 1) was taken. The record, however, now stands at 753·4 m.p.h., having been attained in October in an American aircraft, the Douglas "Skyray" delta prototype in Southern California.

Visitors to Farnborough last year saw all three of the bomber configurations under development in this country. For many it was probably their first sight of the Handley Page "Victor" (Plate 1), which because of its decreasing wing sweep towards the tip is credited with the name "crescent" wing. One of the most impressive demonstrations seen at any Farnborough display was that given by the formation flying of six Avro delta aircraft. It was led by two "Vulcan" bombers, which later gave very convincing demonstrations of their low-speed handling characteristics. These machines have neither flaps nor tailplanes. Amongst the modifications to the Vickers "Valiant" bomber displayed last year was its bogie undercarriage, which replaces the single wheels in tandem on each leg of the Mark 1 version.

Evaluation of these configurations proceeded during the year. They are all based on the same specification. No official decision as to the most suitable form has yet been disclosed.

### Research Aircraft

Whilst it can be confidently expected that this country has under development aircraft capable of sustained supersonic flight no details whatsoever have yet been disclosed. The existence of the "Gyron" axial flow gas turbine was made known, however, during the year, which, it was stated, has been designed specifically for supersonic aircraft. In this sphere it appears that America has a distinct lead. The latest supersonic research aircraft she has developed is the Douglas "X.3," which first flew last October. The designed speed is reported to be 2000 m.p.h. at heights in the region of 80,000ft. It is a piloted aircraft and although its very thin wing, which is unswept but of trapezoidal planform, sustains a loading in excess of 300 lb per square foot, it operates unlike its predecessors without a parent aircraft. We include an illustration of this important machine (Fig. 8). It is 66ft 9in long with a wing span of 22ft 8in.

The only two research aircraft upon which any information became available during the year are both made by Short Brothers and Harland, Ltd. One of these, the "Sherpa," is a private venture by the company with which it is investigating the properties of an aero-isoclinic swept wing. Such a wing is designed to retain a constant angle of incidence when flexed and so avoid the washout which occurs when an ordinary swept wing is loaded. It is described and illustrated in our issue of December 25th. and is shown in flight on Plate 1. In conjunction with this wing the use of all moving wing-tip ailerons is being investigated.

On the other aircraft, the Short "S.B.5," the effect of sweepback is being investigated in the low-speed range. This aircraft, shown in Fig. 9, first flew in December, 1952, and it has swept wings, the degree of which can be adjusted before flight. The tailplane is also variable and can be positioned either at the top of the tail-fin or underneath the fueslage. The aircraft has already undertaken a programme of test flying in the 50 deg. and 60 deg. swept back position. Soon it is to fly with the tailplane in the low position and after that the wing sweep back will be increased to 69 deg.

# Shipbuilding and Marine Engineering in 1953

No. II—( *Continued from page* 16, *January* 1*st* )

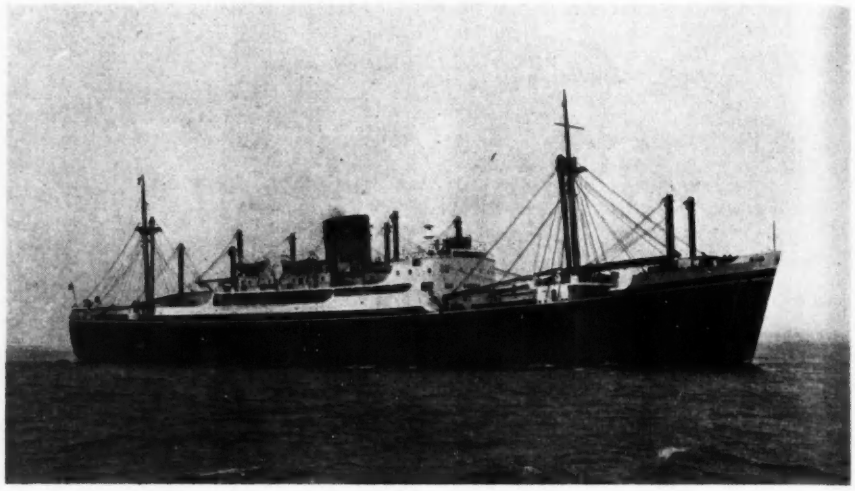
AMONG the papers read before the technical societies during the year, a considerable number were concerned with ship performance. There were some which dealt with such matters as hull strength, machinery developments, problems connected with boilers, and various other subjects related to ship and marine engine building.

One of the most important papers presented was " B.S.R.A. Resistance Experiments on the ' Lucy Ashton ' : Part II, The Ship Model Correlation for the Naked Hull Conditions," by Dr. J. F. C. Conn, Mr. H. Lackenby and Mr. W. P. Walker, read at the Institution of Naval Architects' spring meeting. This paper, abstracts of which appeared in our issues of March 27, April 3 and 10, 1953, dealt primarily with the correlation of the measured full-scale resistance of the ship with the results of experimental tank tests on geometrically similar models of varying lengths. The translation of the model results was effected by means of Froude's and several modern skin friction formulations. Another paper read at the same meeting was " Sea Trials on a Victory Ship, ' AP3,' in Normal Merchant Service," by Professor G. Aertssen, who discussed the trials carried out to determine the efficiency of ship and machinery in different conditions of weather and fouling, linked with a comparison between service data and tank results.

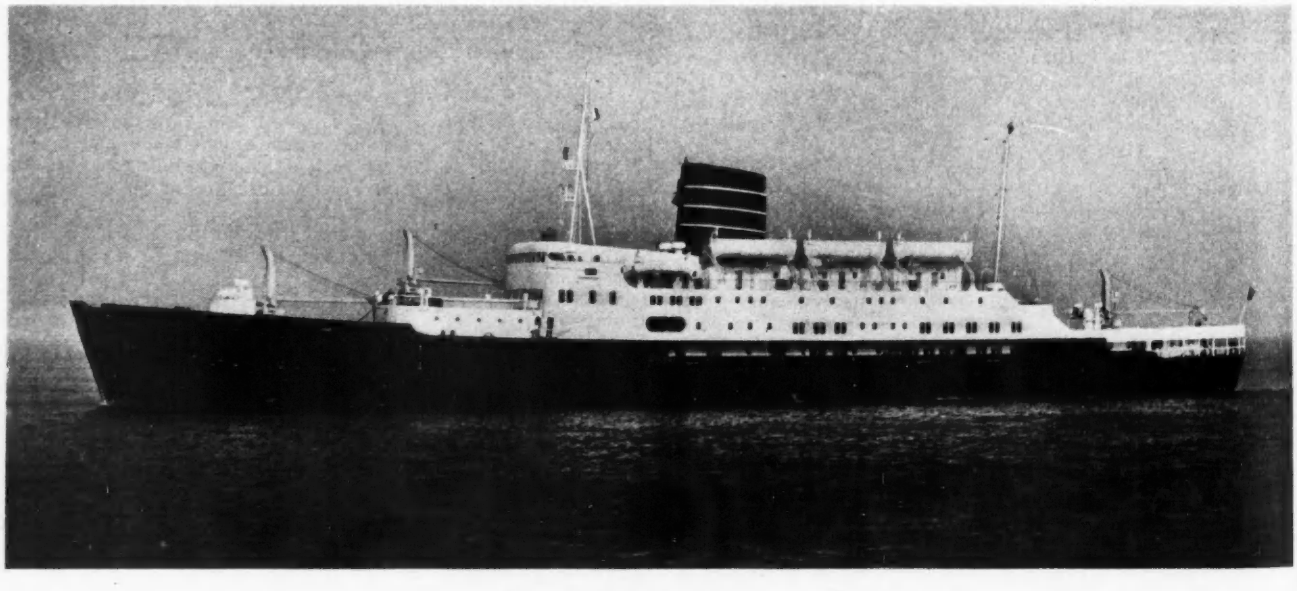
The main purpose of " Water Forces on Submerged Bodies in Motion," presented by Mr. W. C. S. Wigley, was to state the position of our knowledge of methods of calculating the forces and moments acting on a body in motion in a fluid in the neighbourhood of a free surface. In a paper entitled " A Skin Friction Determination Using Wall-Sided Models of Great Draught," Mr. R. T. Shiels, using two fundamental assumptions made by Froude, one of which was reversed, attempted to produce a friction line corresponding to zero beam. A specially designed gravity dynamometer was used and actual wave profiles were compared with those calculated. Also at the spring meeting Mr. J. L. Bartlett, in a paper " The Motion of an Aircraft Carrier at Sea in Relation to the Operation of Naval Aircraft," provided a survey of the assumptions made, the investigations analysed, the data used and the results obtained, when he gave estimates of the vertical movements, velocities and accelerations in parts of the flight deck of an aircraft carrier.

A communication from the National Physical Laboratory was read by Dr. J. F. Allan and Mr. R. S. Cutland, before the North-East Coast Institution of Engineers and Shipbuilders, in the form of a paper, with the title " Wake Studies of Plane Surfaces," which gave the results of experiments to measure the frictional resistance of smooth plank surfaces. New formulæ were given for the width of the friction belt, which was shown not to vary with speed, and a method was outlined for correcting wake-scale effect in estimating ship powers and propeller revolutions from self-propelled model results. Before the Institution of Engineers and Shipbuilders in Scotland Mr. J. Dawson, in his paper " Resistance of Single-Screw Coasters, Part I, L/B=6," gave an outline of the new programme of research for these vessels and discussed the effects on resistance of block coefficient, position of longitudinal centre of buoyancy, midship area and draught. " Improvements in Ship Performance " was the title of a paper presented before the Institute of Marine Engineers, in which Dr. J. F. Allan discussed the improvements effected in various classes of vessel and considered the effect of changes in rudder and stern frame design, and also touched upon vibration problems, and seakindliness.

The development of model research in the Netherlands was reviewed by Professor Dr.-Ir. W. P. A. van Lammeren in his paper " Present-Day Development of Ship Model



**Motor Ship " Cymric "**



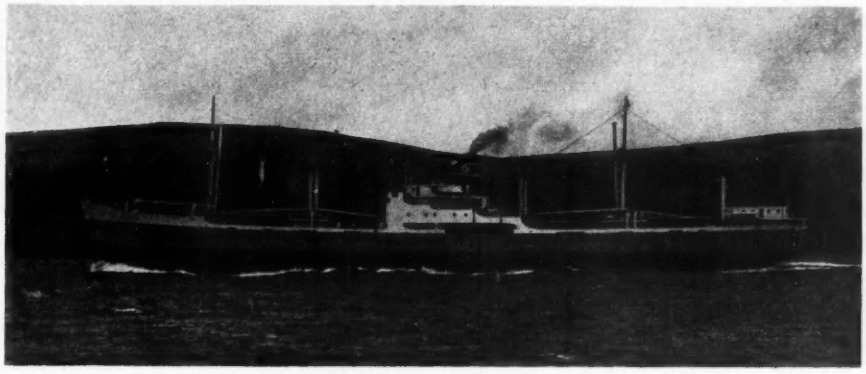
**Steam Ship " Leda "**

Research in the Netherlands Ship Model Basin at Wageningen," which was read at the autumn meeting of the Institution of Naval Architects in Holland. The work, which concerned a wide range of subjects, was set out in two main groups, namely : research to improve hull forms, propellers and rudders, and research concerned with the correlation between tank results and trial trip and service results. At the same meeting, in " The Hydromechanics Research Programme of the Bureau of Ships, U.S. Navy," Dr. F. H. Todd gave some account of the organisation of naval research in the United States and of the methods of administration of the Bureau of Ships programme of fundamental hydromechanics research. Various projects were described and some of the results obtained were given.

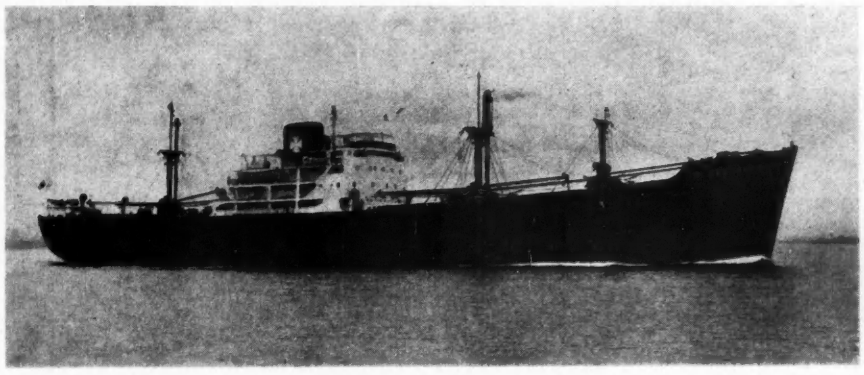
At the spring meeting of the Institution of Naval Architects, Professor L. C. Burrill and Mr. C. S. Yang read the paper " The Effect of Radial Pitch Variation on the Performance of a Marine Propeller," which described the results of an investigation of the comparative effects of various forms of radial pitch variation on the efficiency and performance of a marine propeller in a uniform stream and in non-uniform wake streams representative of twin-screw and single-screw wake patterns. Later in the year Professor Burrill and Mr. A. Emerson discussed the King's College cavitation tunnel and gave the results of propeller tests together with observations on the singing of propellers, based on experiments made in the tunnel, in a paper entitled " Propeller Cavitation : Some Observations from 16in Propeller Tests in the New King's College Cavitation Tunnel," read before the North-East Coast Institution of Engineers and Shipbuilders.

" Vibration Tests of an Up-River Collier, with Special Reference to the Influence of Depth of Water " was the title of a paper presented to the same institution by Mr. W. J. Marwood and Mr. A. J. Johnson. The authors showed the influence of depth of water upon vertical vibration frequencies for different depth of water to draught ratios and that the horizontal modes were not influenced to the same extent. Comparisons were made between the experimental results and those obtained theoretically. Earlier in the year, before the same institution, Mr. H. J. Adams read his paper " Some Further Applications of Moment Distribution to the Framing of Tankers," in which the moment distribution method of analysis was applied to certain tanker frame sections and the value of the strut in the wing tank investigated. During the spring meeting of the Institution of Naval Architects Dr. R. Weck read a paper with the title " Fatigue in Ship Structures," which considered failure in redundant and non-redundant structures, together with its prevention. That welded ships were more likely to develop fatigue cracks than riveted ships was conceded, and the paper gave an account of the testing procedure together with some details of the test pieces and a tabular statement of the results.

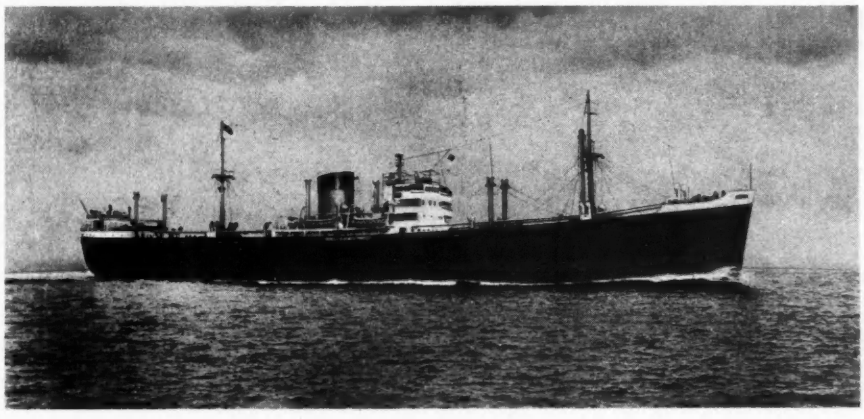
In his paper " Tunnel Type Vessels," read before the Institution of Engineers and Shipbuilders in Scotland, Mr. A. R. Mitchell described the general principle of the tunnel vessel, traced the advances in design during the past fifty years and illustrated a large variety of this design of shallow-draught craft, together with the results of tank tests and trials. In another paper, entitled " A Century of Coaster Design and Operation," read before the same technical society by Mr. J. C. Robertson and Mr. H. H. Hagan, the evolution of the coasting tramp was dealt with and particular reference made to proportions, power and speed



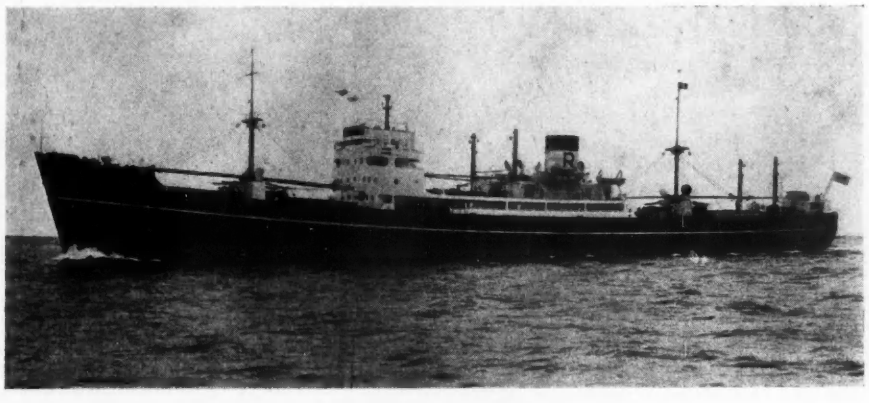
**Steam Ship " Simoa "**



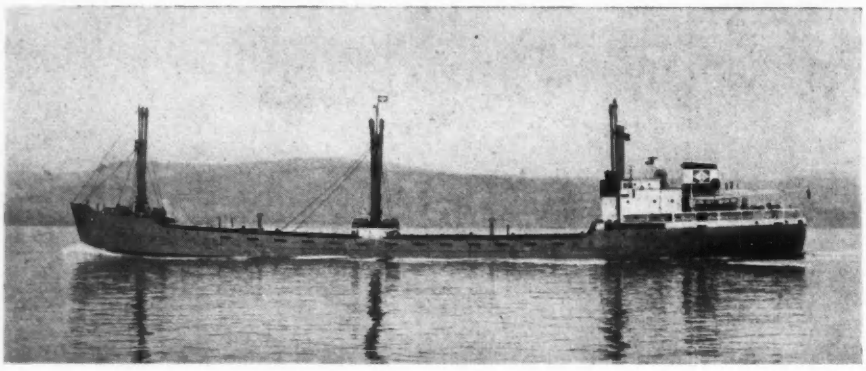
**Motor Ship " Queensbury "**



**Motor Ship " Beaverbank "**



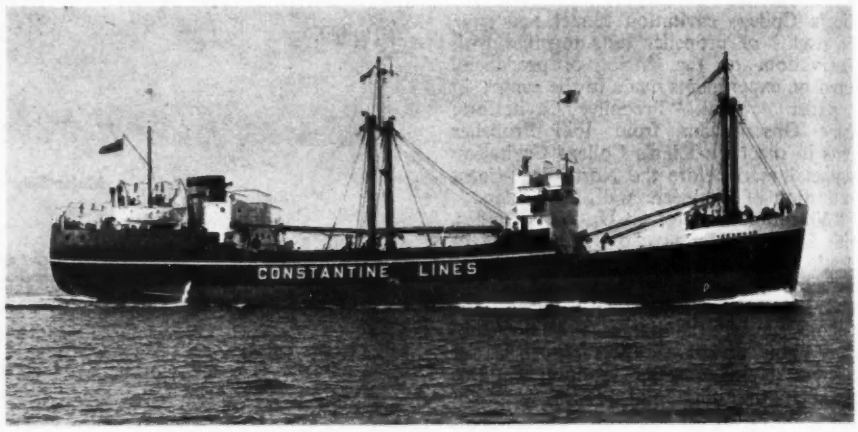
**Motor Ship " Glenmoor "**



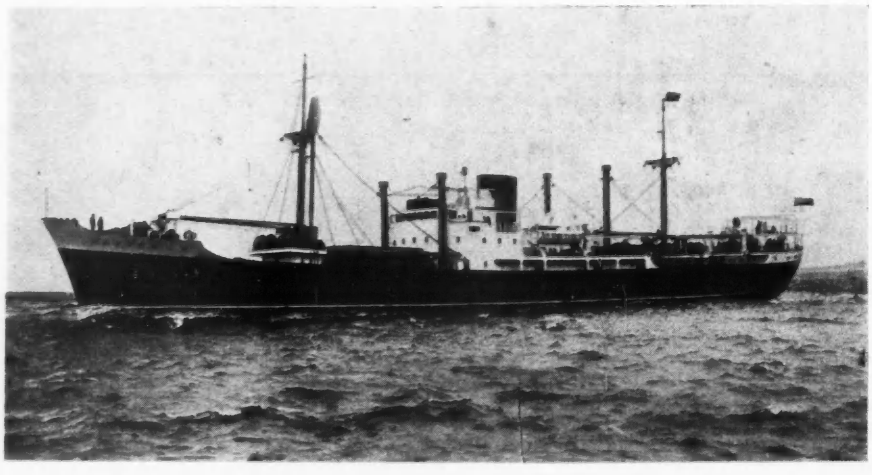
Motor Ship "Longfellow"

and the tendency to increase in size. A technical comparison was made between an old and a modern vessel and future tendencies in design were discussed. In "The Preservation of Oil Tanker Hulls," given before the North-East Coast Institution of Engineers and Shipbuilders, Mr. John Lamb and Mr. E. V. Mathias discussed the problem of preserving the hulls and cargo compartments of oil tankers, together with the measures adopted and projected to reduce wastage. The ways in which heat enters a refrigerated ship and the effects of various depths of insulation were reviewed and the effect of insulation and fan power on cargo capacity and deadweight shown by Mr. K. C. Hales and Mr. J. D. Farmer in their paper "The Insulation of a Refrigerated Cargo Liner," read at the spring meeting of the Institution of Naval Architects. At the same meeting Mr. E. Leslie Champness, in his paper "Large Dry Docks," discussed the trend of proportions of length to beam of merchant ships and gave curves of the widths of dry docks, together with lists of attendant facilities. Economic considerations were related to present-day expansion and earnings, and a drawing was included of a double-ended dry dock arranged for maximum usage.

The autumn meeting of the Institution of Naval Architects was held in Holland, at the invitation of the Koninklijk Instituut van Ingenieurs, and six papers were presented, including "Tests on Launching Greases," by Mr. J. Brown and Mr. J. M. Ferguson. This paper gave the results of an investigation into the frictional properties of launching greases carried out for the B.S.R.A., and offered a hypothetical explanation of the disparity between the coefficients of static and initial sliding friction. An analysis of the classical method of marking off and a comparison made between it and the optical method, which showed the advantages of the latter, was given by Ir. J. H. Krietemeijer, in his paper "Optical Marking-Off System for Plates and Sections in Shipbuilding." This was followed by "On Propeller Manufacture," in which Professor L. C. Burrill considered the changes in design of marine propeller blades and reviewed the improved methods of production. The closing paper, "Investigations of Ships' Hull and Machinery Defects," by Mr. T. W. Bunyan, noted the advances in the art of measurement made by the application of electronics and electrical strain gauges and their assistance in investigating causes of failure, and also included a few examples of techniques applied to actual jobs.




Motor Ship "Teeswood"



Motor Ship "Pavia"

Among the papers presented before the North-East Coast Institution of Engineers and Shipbuilders was "The Influence of Thermal Effects on the Manœuvrability of Marine Turbine Machinery," in which Mr. B. J. Terrell discussed the peculiar requirements of modern turbine machinery during manœuvring and the problems raised by changes in temperature. The phenomena which occurred were described and means of improving manœuvrability were mentioned. Commander (E) A. F. Smith, R.N., in "The Development and Maintenance of Post-War Naval Machinery," indicated the changes necessary in pre-war maintenance policy to allow for the development of advanced designs of machinery and gave examples of post-war naval machinery designs. The ultimate aim of the naval maintenance and repair organisation was stated to be to enable a warship to fulfil all operational commitments. The paper by Mr. J. Smith, "The Use of Heavy Fuels in Diesel Engines of Marine Auxiliary Sizes," described the work carried out on a single-cylinder engine of 9in bore by 12in stroke to determine the modifications necessary to enable the engine to burn heavy fuel with the minimum of operational costs.

The use of heavy fuel was also the subject of Mr. A. G. Arnold's paper, "The Burning of Boiler Oil in Two and Four-Stroke Cycle Diesel Engines and the Development of Fuel Injection Equipment," read before the Institute of Marine Engineers. The experience of burning boiler oil in five different designs of diesel engines was recorded and explanations given of the experiments together with a note of the economies effected. Before the same society Mr. W. Kilchenmann gave a description of the new Sulzer design and made special reference to the heavy fuel problems in his paper "New Designs of Large Two-Stroke Diesel Engines." Other papers read before the Institute were "Operation of a Marine Gas Turbine Under Sea Conditions," by Mr. J. Lamb and Mr. R. M. Duggan, and "Atomic Propulsion—with Special Reference to Marine Propulsion," by Sir John Cockcroft. The former paper gave the results of two years' operation of the 1200 b.h.p. open-cycle gas turbine installed in the oil tanker "Auris." In the latter paper the principles and types of nuclear reactors were discussed and mention made of the reactors adopted for the United States' submarines, while technical and economic problems were

examined together with operational factors.

"Some Factors in the Design and Lubrication of Journal Bearings" was the title of the paper read by Professor A. S. T. Thomson, Professor A. W. Scott and Dr. H. L. McBroom before the Institution of Engineers and Shipbuilders in Scotland. They described the experimental investigations into the effects of oil grooving, bearing material and surface roughness on the performance of bearings and also the effect of use on lubricating oils. A paper, which dealt with tests on forged mild steel shafts as used in merchant vessels, with the title "Investigation of the Effect of Fillet Radii on the Torsional Fatigue Strength of Marine Shafting," was given by Mr. T. W. Bunyan and Dr. H. H. Attia before the same institution. Included among the papers presented before the Diesel Engine Users Association was "Small Air-Cooled Diesel Engines—Development and Applications," in which Mr. C. F. Nossiter dealt with the design details of such engines and discussed future possibilities. Another paper read before the association was "Noise—Practical Aspects," by Mr. J. E. Holton, who discussed the propagation of sound and its measurement and noise reduction.

Progress in marine boiler design during the last decade was reviewed and examples given of different designs of boilers for various classes of ships by Mr. R. L. J. Hayden in his paper "Experiences During the Last Ten Years in the Design of Marine Boilers," read before the North-East Coast Institution of Engineers and Shipbuilders. Operating experiences with each part of the generating unit were described and the trend of future development indicated. Before the same society Mr. D. W. Crancher gave the results of work carried out for B.S.R.A. in a paper entitled "The Thickness of Tubes for Water-tube Boilers," in which the boiler tube thicknesses required by the classification societies were compared and the factors affecting the thickness examined. A new approach to the problem was given in which the optimum thickness was defined and a simple design formula suggested. Mr. B. Taylor and Mr. H. Booth, in their paper "Service Performance of Boiler Brickwork—the Causes and Extent of Wastage," given before the Institute of Marine Engineers, described an investigation, undertaken by B.S.R.A. and the British Ceramic Research Association, into the deterioration of refractory materials in water-tube boilers, causes of wastage, and methods of improving the life of brickwork. The results of many boilers were summarised.

*(To be continued)*

## Motor Yacht "Tindor"

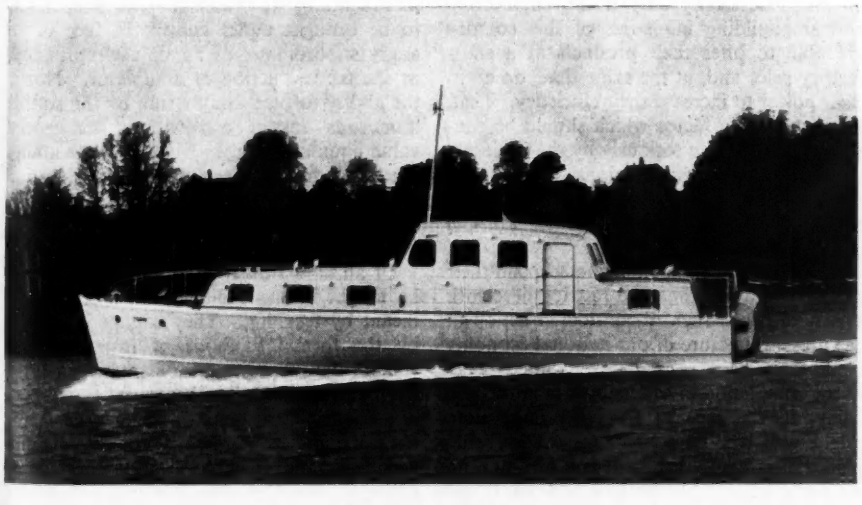
ONE of the boats recently completed at the yard of Grimston Astor, Ltd., of Bideford, Devon, is the twin-screw motor yacht "Tindor," which has been constructed using the two-way tension system associated with the builders. The specification called for a yacht capable of making fast passages to the Continent and suitable for use in the Mediterranean, while the length was limited to a maximum of 50ft to ensure good manœuvrability in the Thames and in the canals of Europe. Besides certain requirements regarding the accommodation the yacht was specified to be capable of maintaining a speed of 16 knots with five passengers and luggage on board, plus sufficient fuel to make the return crossing to Belgium.

The "Tindor," which we were able to inspect recently, is shown in the accompanying photograph. It fulfils the specification requirements and has a length of 50ft by 14ft 6in beam by 2ft 9in draught, a displacement of about 10 tons and a net registered tonnage of 22·96. She is a light and airy craft, with ample headroom throughout, built of aluminium alloy supplied by the British Aluminium Company, Ltd., and powered by two Mark S6M Perkins diesel engines. These six-cylinder, four-stroke engines, which have a bore of 4⅜in by a stroke of 5in, each develop 100 b.h.p. at 2000 r.p.m., and gave the boat a trial speed of 17 knots.

The yacht is plainly but comfortably furnished throughout and the deck saloon, which is fitted with settees and a folding table, has the steering position to port at the forward end and a chart table to starboard. From the saloon, steps lead forward and down to the galley which is fitted with a Calor gas cooker, a refrigerator and a water heater, arranged to starboard, and to port there is a small bathroom. Further forward there is a two-berth cabin which has an additional small size berth arranged transversely at the aft end, while a watertight door in the forward bulkhead opens on to the crew's cabin. This space is equipped with two canvas cots and a vertical access ladder to a hatch on the foredeck and a water-tight door forward gives access to the fore peak, which is arranged as a toilet compartment. Steps at the aft end of the saloon lead down to the spacious owner's stateroom, which is comfortably furnished.

Both sets of steps from the saloon are hinged so as to give access to the space under the saloon, at the forward end of which a fuel tank and a fresh water tank, each of 240 gallons capacity, are arranged in the wings, leaving the space in the centre for the stowage of baggage. The aft end of the compartment under the saloon forms the engine-room, in which the twin Perkins diesel engines are mounted, and each drive a three-bladed light alloy propeller, of 17in diameter by 13½in pitch, and fitted to 1½in diameter stainless steel shaft, through a Silentbloc radial thrust coupling. The engines have a combined fuel consumption of about 10 gallons per hour, so that the amount of fuel carried is sufficient for approximately 380 sea miles. Also in the engine-room is a Stuart Turner diesel auxiliary lighting set.

The yacht is designed to take the ground without the need of sheer legs, and for that purpose is fitted with specially shaped skegs which support the boat and protect the propellers. Both the combined shaft brackets and skegs, the stern tubes and the rudders are castings of heat-treated aluminium alloy to standard specification L.M.10W., while for the hull plating, transom and decks 10 S.W.G. sheet in the quarter hard condition to specification N.S.5 has been used, and similar sheets, but of 12 S.W.G., for the bulkheads. Included among the equipment are 55 lb and 35 lb C.Q.R. anchors, a Stuart Turner electric submersible fire and emergency bilge pump, and a 10ft aluminium alloy dinghy, supplied by the Viking Marine Company, Ltd. This is stowed against the transom and the hoisting arrangements are such that the dinghy can be hoisted and stowed single-handed.



Motor Yacht "Tindor"

## Engineering Drawing Practice

PARTICULAR importance attaches to the publication by the British Standards Institution of a new and more comprehensive edition of B.S. 308, "Engineering Drawing Practice." The need for a new standard was particularly felt during the late war, when it became evident that the dimensioning and tolerancing of many engineering drawings, however well they conformed to the accepted standards, did not always ensure that components would assemble or function correctly. As a result of these difficulties the Inter-Services Committee on Dimensioning and Tolerancing of Drawings was formed in 1944, and in 1948 this committee was responsible for publishing a manual, "Dimensional Analysis of Engineering Designs." A number of the fundamental principles laid down in this manual have, in general, been applied in the drafting of the new B.S. 308.

A B.S.I. sub-committee to undertake a complete revision of B.S. 308 : 1943 was formed in 1950, and it included representatives of the heavy electrical and mechanical engineering, aeronautical, automobile and radio industries, British Railways, the Ministry of Supply, the Admiralty, and the National Physical Laboratory.

The new specification, which costs 10s. 6d. net, is divided into two sections. The first section—General Practice—is based upon the previous B.S. 308 : 1943, but whilst the section has been amplified in some respects, it has been considered advisable to confine the standard to recommended principles and methods to be followed in the preparation of engineering drawings. Subjects such as architectural drawings, survey plans, graphs, reproductions of drawings, and the nature and handling of drawing materials have been excluded, as such matters are more fully and appropriately dealt with in other standards.

Section two—Dimensioning and Tolerancing—is entirely new and presents a great advance in the technique of drawing statement. It lays down a number of general principles, of which the most important are that the drawing should define the finished product as required by the designer, and that dimensions which affect the function of the product should be expressed directly on the drawing. It also deals with ways of indicating dimensions, tolerances and notes on drawings, and with the dimensioning of common features, including a special section on the subject of tapers.

This second portion of the standard is devoted mainly to the principles and methods of expression of geometrical tolerances for straightness, flatness, parallelism, squareness, angularity, symmetry, concentricity, roundness and position. By the judicious application of these methods it will be possible in future to define precisely acceptable limits of geometrical form, instead of relying on individual judgment or conjecture.

FINNART-GRANGEMOUTH PIPELINE.—Work designed to increase the capacity of the 57-mile long pipeline from Finnart, in Loch Long, to the Grangemouth refinery from 2,400,000 tons a year to 3,250,000 tons is expected to be completed this month. To give the increased capacity an additional pump has been installed at Finnart and a new booster pumping station at Balfron.

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## WAGES

To-day, the Courts of Inquiry, which the Minister of Labour has appointed to examine the wage disputes in the engineering and shipbuilding industries, begin their sittings. There are two courts, composed of the same people, and presided over by Lord Justice Morris ; one will deal with the engineering industry and one with the shipbuilding industry, and separate reports are to be presented to the Minister of Labour as speedily as possible. The Minister's decision to appoint these courts was announced on Thursday of last week after further talks with representatives of the Engineering and Allied Employers' National Federation, the Shipbuilding Employers' Federation, and with the Confederation of Shipbuilding and Engineering Unions. The employers' representatives had already stated that their views concerning the rejection of the unions' claim for a 15 per cent wage increase were unchanged. But it should not be forgotten that in announcing to the unions, in November, their reasons for the final rejection of the claim, the employers intimated that they were "prepared to give the facts and figures at a Ministry of Labour inquiry." The Confederation of Shipbuilding and Engineering Unions, however, staged a twenty-four-hour stoppage of work as a protest against the rejection, and, just before Christmas, decided to instruct its affiliated unions to ban overtime and restrict piecework as from January 18th. When the Minister of Labour saw the Confederation's representatives last week, he asked them to consider the suspension of such action, and last Monday it was announced that the executive had agreed to recommend a postponement of the ban until the courts' findings were made known.

Thus, the Courts of Inquiry can set about their task in a slightly clearer atmosphere than that which prevailed prior to the Minister's intervention. Nevertheless, it is to be regretted that up to the present the union confederation as a whole has shown little sign that it is prepared to see in their true perspective the economic factors upon which the rejection of the claim was based. The demand for an increase of 15 per cent in the wages of adult male workers was formulated on the grounds of the rise in living costs, high profits in the engineering and shipbuilding industries, and greater output. The engineering and shipbuilding unions, however, appear to be strangely unconcerned about the very large proportion of profits which, in the post-war years, has been ploughed back for the renovation and expansion of the two industries, without which renovation and expansion both industries would have found it impossible to hold their position in an increasingly competitive world. Neither have the unions shown any great readiness to accept the fact that, whilst in the last five years the retail price index has increased by 35·6 per cent, average weekly earnings of adult male workers in the engineering industry have risen by 48 per cent for time-workers and 47 per cent for piecework. Another important matter, which was emphasised during the negotiations on the claim, is still being given too little attention in many places. It is the decline in the amount of orders reaching the engineering and shipbuilding industries, especially from overseas countries. In the last twelve months there has been a falling off in the exports of many engineering products, and foreign competition is growing stronger. That competition can be met successfully only if the engineering and shipbuilding industries of this country are able to offer their products at a satisfactory price and, at the same time, do all in their power to increase their efficiency. That, we suggest, is a factor which should be considered much more seriously by the engineering and shipbuilding unions before they persist further with any wage claim which might quickly jeopardise the future of the industries they represent.

The decision of the unions to suspend their threat to ban overtime and restrict piecework is a wise one. Such ill-considered action at the present juncture of our national economy could only have caused unwarranted delay in the completion of orders now in hand, and delay, in the face of foreign competition, might well lead to subsequent orders being placed elsewhere. Whilst it is a pity that no generally acceptable basis could be found last week for a resumption of negotiations whereby the dispute could be settled, the Courts of Inquiry will serve a useful purpose. Their terms of reference require them to examine impartially all the facts and circumstances of the dispute. Their task is undertaken in the interests of the nation, and, although neither side is bound to accept the recommendations of the courts, their findings, it may be hoped, will assist the disputants to evade the threatened stalemate. The new year has begun with some encouraging reports of improved industrial production in the closing months of 1953. In the longer term, it would mean disaster to the engineering and shipbuilding industries were they to be outpriced, by continually rising costs, from those world markets which are so essential to this country's economic survival.

## PROPER STUDY OF MANKIND

Only a part of the business of management consists of the application of the techniques of accountancy and economics and of the appreciation of points of industrial law. The more essential part is skill in the handling of men. A junior executive must be capable not only of welding his subordinates into an enthusiastic team, but also of acting, himself, as a member of an equally enthusiastic team under a higher executive. He must also—sometimes a more exacting task—prove capable of working amicably with other executives of his own grade whose functions may overlap and mingle to some small or large extent with his own. He has therefore very much to learn. The most proper of his studies should be man. He has to discover that each of the men within his charge needs, in some personal degree, scope to express his own individuality, if he is happily and willingly going to contribute to the work of the team as a whole ; that it is of little use trying to force people to do what they do not want to do and far better to persuade them to want to do it, or, at least, to see that it must be done; and that there is not very much hope of rectifying a man's defects, but a great deal to be hoped of seeking out and developing his more valuable qualities. Tact has to be acquired in handling juniors as well as seniors, and particularly in appreciating how variable and how emotional is human nature. A distinction has to be learned between firmness and mere obstinacy, masquerading as firmness. The temper has to be brought under control in face of an angry subordinate, of an unjust reprimand, or the tactless action of a superior. Nor is the ability to turn away wrath by the soft or humorous answer one without its special value upon occasion ! Above all, the ability needs to be acquired to see a situation sympathetically as other people may see it and thus remain friendly in face of an acute difference of opinion.

Of all these human abilities few can really be taught in the ordinary sense of what is meant by teaching. They cannot be taught by the formal methods of instruction by which the techniques of management—that is, accountancy, industrial law, economics, &c.—are taught and have been, for long, taught in numerous courses at universities, and technical and commercial colleges. But that does not mean that they cannot be taught at all. Just as in learning

theory in a technical course a student is acquiring the recorded and correlated experience of his fathers, so, in some degree, can experience in certain rudiments of the more human side of management be passed on to others. It is the method of teaching that has to be different, not its object. That courses of education in the subject have already proved valuable is shown by the popularity of the excellent, even if somewhat elementary, training-within-industry scheme, the work of bodies such as the Tavistock Institute of Human Relations in Industry, the Industrial Welfare Society, Institute of Industrial Administration, &c., the number of internal courses organised by large companies for their own employees, short residential courses arranged at adult education centres, and the quite recent foundation for senior executives of the Administrative Staff College at Henley. But in all those cases firms sponsor the sending of men to take the course or the bringing of the course into the works. In addition, there is also evidence of a wider demand for some form of training in management. Numbers of people attend, unsponsored, at technical colleges and other establishments running courses in the subject. There, unfortunately, there is no guarantee, as there is for sponsored courses, that industry has any influence over the suitability of the courses for their purpose. We confess to feeling far from convinced that some of these external courses have very much value except in relation to managerial techniques. For to a large extent the problem of training for management is that of how best and most quickly to develop a student's personal qualities, more particularly, perhaps, his self-critical ones. That, no doubt, is the reason why the more successful of the methods employed have been based upon the syndicate and the discussion group. We cannot help but feel that education of this character is best undertaken either within industry itself or with the very close co-operation of industry.

A man of high technical attainments and great specialist knowledge will hold a high technical post in industry regardless of personal defects of character that may make him difficult to work with. But high knowledge of managerial techniques and success in courses of training in management do not at all necessarily qualify a man for a high managerial post. To quote from a booklet on "Education and Training for Management," just issued by the Federation of British Industries, "the criterion of an individual's progress in an industrial organisation is not how much he knows or what qualification he holds, but how he acts and thinks in any given situation." That amounts to a contention that learning how to manage is a matter of garnering experience, and that the bulk of the experience can only be gained by doing a managerial job. But it does not follow that the taking of courses in management is a waste of time. For exactly the same contention can be upheld about the technical man whose technical knowledge is of very limited value until he has garnered practical experience in its use. Yet few nowadays would deny the value of a technical education. By analogy it is unreasonable to suppose that a course in management will immediately fit a man for a high executive post. But if it is well adapted to its purpose it may well fit him to learn more rapidly from experience. Particularly is it likely to do so if industry takes a close interest in the courses offered, collaborates with the teaching bodies concerned, and releases senior executives from time to time to help the work. As the booklet forcibly puts it: "The initiative in arranging courses in the past has come largely from professional bodies and educational establishments. It is imperative that, in a matter as important as management training, industry should not only co-operate, but take the lead." That may be to exaggerate the part industry should play. Yet it may well be true that "Only in this way will it be possible to dispel apathy and develop courses which meet industry's needs."

## Obituary

### PROFESSOR DR.-ING. GUSTAV BAUER-SCHLICHTEGROLL

IT is with deep regret that we record the death of Professor Dr.-Ing. Gustav Bauer-Schlichtegroll, which took place on Sunday, December 6, 1953, at his home, 82, Mittelweg, Hamburg, following a long illness and shortly after his eight-second birthday.

Dr. Bauer was the only son of Geheimrat Dr. G. Bauer, Professor of Mathematics in the University of Munich, and was born on December 1, 1871. From an early age he showed a strong inclination towards natural science and biology, and on entering the university he started to study medicine. During these studies the chance reading of a technical article on a large marine steam engine caused him to change his course and to devote all his time to engineering subjects. He completed his studies at the Munich Technical High School, and obtained his engineering diploma with distinction, and, shortly after, the degree of Dr.-Phil. in the subjects of mathematics, physics and chemistry. His thesis was written on original experiments which he carried out on the exact measurement of the specific weight of saturated steam.

In order to obtain practical experience in the handling of large marine steam engines, Dr. Bauer made several voyages in ships of the North German Fleet, through the kindness of his friend, Dr. Wiegand, who was then general manager of the company. Dr. Wiegand also introduced him to Geheimrat Justus Flohr, who was then head of the marine engineering section of the Aktiengesellschaft "Vulcan" at Stettin-Bredow. It was on December 1, 1895, that young Bauer entered the service of that firm. Seven years later, in 1902, he had become, at the age of thirty-one, chief assistant to Dr. Justus Flohr. His work included the applications of the Yarrow Schlick and Tweedy system of balancing to high-speed marine steam engines, and the design and construction of high-duty water-tube boilers.

At that time, the Vulcan Company was the leading shipbuilding and marine engineering firm in Germany, and from 1889 to 1892 it had built and engined the first German twin-screw liner, "Augusta Victoria" and the "Fürst Bismarck." In 1897 the North German Lloyd express liner, "Kaiser Wilhelm der Grosse" was completed, and Dr. Bauer sailed with her on her maiden voyage. Later, she was the first German liner to gain the "Blue Riband" of the Atlantic. In the years which followed up to 1904, other notable ships built and engined at the Vulcan yard included the "Deutschland," the "Kronprinz Wilhelm," the "Kaiser Wilhelm II," and the "Kronprinzessen Cäcilie." Of these, the "Deutschland" and the "Kaiser Wilhelm II" were also holders of the "Blue Riband." Dr. Bauer was responsible for design and construction of the machinery and boilers of these ships.

About the same time the Vulcan yard constructed several naval vessels for the German Navy, and for other foreign navies, among which may be mentioned the torpedo-destroyers "Nowik" and "Bogatyr" for the Imperial Russian Navy, which, at 36 knots, were among the fastest ships of their class afloat. Dr. Bauer paid many visits to Russia in connection with the construction of these vessels.

In these busy years he also found time to write his book on the theory and practice of marine engine and boiler construction, entitled *Handbuch der Berechnung und Konstruction der Schiffs-Maschinen und Kessel.* It was first published in 1902 and later editions which followed at intervals were translated into most European languages and into Japanese.

When Dr. Justus Flohr retired, Dr. Bauer was given complete charge of marine engineering work. Between 1905 and 1910, under his direction, Professor Dr. Föttinger perfected the Föttinger hydraulic transformer, which, in combination with a train of gearing, was to play an important part in the development of ship's propelling machinery, diesel locomotives and road transport vehicles. To-day, such couplings and gears have been built up to a collective total of several hundred million horsepower.

It was about 1908 when Dr. Bauer, director of the marine engine section of his firm with a seat on the board, came to Hamburg to the new Vulcan shipyard and engine works, which had been laid out near Hamburg on the River Elbe. One of his first jobs was to supervise the designs for the propelling machinery of the new Hamburg America express liner, "Imperator," which had just been ordered. That ship was completed in 1913 and was, we may recall, a 52,000-ton liner with propelling machinery of 80,000 s.h.p. on four screws. She was the first of a series of giant German liners, and served as a type ship, for the construction of the later liners "Vaterland" and "Bismarck," which were built by Blohm and Voss, of Hamburg.

After the first world war, Dr. Bauer was intimately concerned with the further development of the Föttinger hydraulic transmitter under the names of "Vulcan-Coupling" and "Vulcan-Drive" at the Vulcan Works at Hamburg. This type of drive was successfully used for both naval ships and merchant vessels. In England it was developed in collaboration with Mr. Harold Sinclair as the Vulcan-Sinclair coupling by the Fluidrive Engineering Company, Ltd., of Isleworth, mainly for automobile and industrial applications. Vulcan couplings totalling over 200 million horsepower have now been constructed. A further development of this principle, which was to carry Dr. Bauer's name, was the Bauer-Wach exhaust steam turbine, combined with a reduction gearing and hydraulic transmitter of Vulcan design. Licences for the construction of this patented design of propelling machinery were taken out by many firms. The principal British firms included William Beardmore, Ltd., on the Clyde, and Swan, Hunter and Wigham Richardson, at Wallsend and Walker-on-Tyne. The development of the Bauer-Wach

exhaust steam turbine brought Dr. Bauer into personal touch with marine engineers in many parts of the world, and with his fluent command of English and French he made friendships, which he treasured to the end of his life. In 1926 the Vulcan shipyard and engine works was acquired by the Deutschen Schiff und Maschinenbau Aktiengesellschaft (Deschimag), a Bremen foundation, and from that time onwards Dr. Bauer's main duties were carried out from the Aktiengesellschaft Weser, the Bremen branch of the Deschimag concern. It was here that he undertook the design, layout and construction of the propelling machinery for the North German Lloyd express liner "Bremen," which was ordered from Deschimag in 1926 and was completed in 1929. The 120,000 s.h.p. geared turbine machinery was a great success, and the "Bremen" gained the "Blue Riband" on her maiden voyage.

Between the years 1929 and 1939 Dr. Bauer worked in close collaboration with the Wagner Hochdruck K.G. of Hamburg, and was technical adviser to the firm, which developed high-pressure, water-tube boilers for fast naval and mercantile ships. His own firm, the Aktiengesellschaft Weser, built and engined the two East Asia passenger liners "Scharnhorst" and "Gneisenau," which, along with the turbo-electric liner "Potsdam," built by Blohm and Voss, of Hamburg, were among the first high-pressure boilered ships for merchant service. In these years, too, Dr. Bauer found time for further literary activities in the German and foreign Press, and he began his lectures at the Technical University in Berlin.

During the period of the second world war, the Deschimag concern, to which belonged the Seeback Shipyard in Bremen, and the Vulcan yard at Hamburg and at Stettin, designed and constructed high-pressure propelling machinery, not only for its own ships, but for naval and merchant ships built in other shipyards. Following this new arrangement, Dr. Bauer was made general technical director of the Deschimag and had full responsibility not only for propelling machinery, but for shipbuilding in all the Deschimag yards. Towards the close of the year 1946 Dr. Bauer retired from the board, but to the end of his life he remained technical adviser to the group.

In his long and successful life, Dr. Bauer never sought outside honours, but his work was recognised by many bodies. The Schiffbautechnische Gesellschaft, of which he had been a council member for many years, gave to him its highest honour, the Gold Medal. The Charlottenburg Technical High School made him an Honorary Professor on the Berlin Technical University staff, and a member of its teaching body. He was also awarded the Dr.-Ing. degree. On his seventieth birthday the German Government recognised his valuable work by conferring upon him the Adlerschild. The technical Press outside Germany recognised the great value of the work he did for German shipbuilding and engineering, and he received tributes from technical institutions in many countries.

Those of his friends who knew him well, his colleagues who were privileged to work with him, and the many students who attended his lectures, will long remember his tall and distinctive bearing, and his love of sport which enabled him to play a good game of tennis even in his later years. He was a leader in his own country, who, through his work, his teaching, and his books, widely influenced others and did much to raise the technical standards of his chosen profession.

## Literature

*Public Health Engineering.* By PETER C. G. ISAAC, B.Sc. (Eng.), S.M., A.M.I.C.E., M.R.San.I. London: E. and F. N. Spon, Ltd., 22, Henrietta Street, W.C.2. Price 36s.

PROFESSOR GORDON M. FAIR, in the Foreword to this book, refers to the "Great Sanitary Awakening of Great Britain in the mid-nineteenth Century." It was left to our American colleagues to find a name for it and, indeed, to realise and explore the broader implications of public health engineering. Since the late war some of the leading American thinkers on this subject have visited Europe with missionary zeal and offers of characteristic generosity from the Rockefeller Foundation, in order to enlighten us and, perhaps, to restore to its former brilliance the candle lit by Chadwick a century ago. The inauguration of the public health division of the Institution of Civil Engineers in 1950 and the establishment of post-graduate courses at Durham and London Universities reflect this re-awakening interest; Mr. Isaac's book is timely.

The writer on a subject of such wide implications is faced with some difficult decisions, especially when he has less than 300 pages of fairly open type at his disposal. Engineering in its broadest sense pervades almost every branch of our lives, and there are few engineering activities which could be said to have no bearing on public health; especially is this the case if mental health be taken into account. In his Preface, the author acknowledges that he has selected "those aspects of the engineer's work" which make "the most direct impact on the health of the public." He proceeds to deal broadly with the subjects of water collection, treatment and distribution; sewerage, sewage treatment, river pollution and the treatment of trade waste waters; refuse disposal; atmospheric pollution, and, lastly, but rather surprisingly, district heating. Under the heading of "Water Quality," Mr. Isaac gives a useful summary of the diseases, the spread of which is known to be associated with water. In his chapter on water treatment he appears to accept the idea of mass prophylaxis with greater complacency than is felt by many members of the general public.

One would have liked to see a chapter devoted to the problems of public health in those hot climates where the field of work is enormous and as yet relatively untouched. Among such problems are those associated with the development of large schemes of river control and irrigation. In his reviews of current engineering practice the author has had to condense his material and is inclined to quote particular cases where a broader treatment might serve his purpose better. This tendency is noticeable in the illustrations, many of which show special applications where the principle could have been shown more clearly by a generalised sketch. His references to land treatment, discharge to sea, effluent recovery and the water carriage of refuse seem inadequate and would warrant expansion. This might be done at the expense of the sections dealing with rainfall and surface-water run-offs, on which there is a wealth of other literature. It is, however, easy to criticise the details and point to the omissions in what is, nevertheless, a very capable outline of the generally accepted practice in public health engineering.

Mr. Isaac has written a book which will be valuable to students and may be read with profit by any practising sanitary engineer. It is well presented and logical in its arrangement. The "selected references" at the end of each chapter will enable the student to follow up special lines of study; there are also useful indexes of both subjects and authors. The author shows commendable concern about the problems of trade effluent treatment and the wastage of soil fertility which results from our modern way of life. It is no disparagement of Mr. Isaac's book to express the hope that before long he may produce a larger volume, perhaps in collaboration with an experienced medical officer, a chemist, a practising engineer and an expert on tropical medicine—but this will not be the book which he set out to write on this occasion.

## SHORT NOTICES

*The M.K.S. System of Units.* By T. McGreevy, M.Sc. Tech., M.I.E.E. London: Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, W.C.2. Price 21s.—Two main groups of electrical engineers are catered for in this guide to the M.K.S. system of units. The first group includes those engineers and physicists who, after being brought up on the C.G.S. system of units are unlikely to change to the M.K.S. system in day-to-day work but who want to be familiar with it because it is being used to an increasing extent in technical literature. For this group the approach to the subject is via the C.G.S. system, making use of the reader's existing knowledge and this technique forms the basis of the first five chapters of the book. This method of treatment should suit the busy engineer who may be little interested in learning about the new system of units *ab initio*. The second group of readers includes teachers of electrical engineering and students with no prior knowledge of electrical technology. For this group there are eleven chapters in which the M.K.S. system of units is approached directly from first principles in such a way that students may come to use the system naturally in their later work. Included in the appendices there are a number of curves plotted in M.K.S. units, and brief notes on other systems of units.

## BOOKS RECEIVED

*Hydraulique Technique.* By C. Jaeger. Paris: Dunod, 92, Rue Bonaparte (VI), Paris. Price 4,900 F.

*Manchester Association of Engineers, Transactions,* 1951-52. Published by the Association, 20, Booth Street, Manchester, 2.

*How I Became an Engine Driver.* By N. McKillop. Edinburgh: Thomas Nelson and Sons, Ltd., Parkside Works, Edinburgh, 9. Price 5s.

*Statistical Methods in Electrical Engineering.* By D. A. Bell. London: Chapman and Hall, Ltd., 37, Essex Street, W.C.2. Price 25s.

*Heat-Resisting Steels and Alloys.* By C. G. Conway. London: George Newnes, Ltd., Tower House, Southampton Street, W.C.2. Price 25s.

*Manual of Mechanical Power Transmission.* Third edition. London: Trade and Technical Press, Ltd., 65–66, Chancery Lane, W.C.2. Price 51s.

*Résistance des Matériaux Théorique et Expérimentale.* By R. L'Hermite. Paris: Dunod, 92, Rue Bonaparte (VI), Paris. Price 8,400 F.

*A Handbook on Die Castings.* By F. D. Penny. London: Her Majesty's Stationery Office, Atlantic House, Holborn Viaduct, E.C.1. Price 6s.

*Gesammelte Berichte aus Betrieb und Forschung der Ruhrgas Aktiengesellschaft.* Germany: Vulkan-Verlag, Wiesenstrasse, 55, Essen. Price Dmk. 12.

*Fire Protection Year Book* (1954). Fourteenth edition. Compiled by G. F. D. Pratt. London: Benn Brothers, Ltd., Bouverie House, 154, Fleet Street, E.C.4. Price 12s. 6d.

*The Mechanics of Engineering Soils.* Second edition. By P. L. Capper and W. F. Cassie. London: E. and F. N. Spon, Ltd., 15, Bedford Street, Strand, W.C.2. Price 25s.

*F.B.I. Register,* 1954. Published for the Federation of British Industries by Kelly's Directories, Ltd., and Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 42s.

*The Dynamics and Thermodynamics of Compressible Flu'd Flow.* Vol. I. By A. H. Shapiro. New York: The Ronald Press Company, 15, East Twenty-Sixth Street, New York, 10. Price 16 dollars.

*Cathodic Protection of Pipelines and Storage Tanks.* By V. A. Pritula. London: Published for the Department of Scientific and Industrial Research by Her Majesty's Stationery Office. Price 10s. 6d.

# Electrical Engineering in 1953

No. II—(*Continued from page 27, January 1st*)

## Nuclear Reactors for Electric Power Generation

BEFORE leaving the subject of electricity generation some reference should be made to the prospects of using nuclear energy as a substitute for combustible fuels. A general survey of progress in atomic energy was given in last week's issue (page 5); for the present we are concerned only with the nuclear reactor as a prime mover in the generation of electric power.

The United States of America is the only country to have announced the production of useful amounts of electricity by this means. A statement from the U.S. Atomic Energy Commission shows that on February 24th an experimental homogeneous reactor at the Oak Ridge National Laboratory was brought up to its full designed heat output—equivalent to 1000kW.

In this form of reactor a single homogeneous solution serves as fuel, moderator and coolant. The heat produced by the nuclear reaction in the uranium fuel in the solution is abstracted by pumping the hot radio-active liquid through a heat exchanger, which generates steam to drive a turbo-alternator.

Initially an output of about 150kW was obtained from this installation at Oak Ridge. After the early periods of low-power operation the experimental work was pursued at higher powers with the object of studying the suitability of this design for full-scale reactors. It may be recalled that, after two years of development and design, work was started on this reactor at Oak Ridge and that the reactor became "critical," achieving its initial nuclear chain reaction on April 15, 1952.

Reference was made in last week's article, "Atomic Energy in 1953," to the co-operative work that is being done by the U.S. Atomic Energy Commission with various power companies and manufacturers to examine the possibilities of the joint production of electric power and fissionable materials. Two of the proposals under consideration jointly by the Commonwealth Edison Company and the Public Service Company of Northern Illinois were described in an article, "Nuclear Reactors for Electric Power Generation," in our issues of August 14 and 21, 1953.

The first proposal involves a gas-cooled reactor consisting of two 40ft diameter circular cylinders of graphite containing a lattice of natural uranium slugs, cooled by helium. To allow for pressurisation the reactor is enclosed in a spherical steel shell. The whole reactor is shielded by a reinforced concrete structure consisting of an arch 80ft long with a height of 65ft and a span of 96ft and with vertical end walls, one of which is fixed while the other is movable, to give access to the reactor. The helium is heated in its passage through the reactor and then passes through boilers where feed water is converted to steam. The helium temperature is 650 deg. Fah. at the inlet to the boiler and 384 deg. Fah. at the outlet and circulation is maintained by blowers which return the helium from the boilers to the reactor.

With a helium circulation of $3{\cdot}27\times10^6$ lb per hour, a boiler heat input of $1085\times10^6$ B.Th.U. per hour, steam at 525 deg. Fah. and 265 lb per square inch abs and a condenser back-pressure of 2·5in Hg, the calculated net electric power will be 46·7MW, allowing 15kW of auxiliary power to be taken from the alternator.

The second design is based on a liquid-cooled reactor consisting of a vertical cylindrical pile enclosed in a spherical shell suitable for an internal pressure of 800 lb per square inch abs; heavy water ($D_2O$) serves as the coolant, moderator and reflector. The pile is made up of a number of fuel elements each consisting of an assembly of uranium cells in a thin metal casing placed in a vertical cylindrical channel. Heat generated in the uranium cells is transmitted through the thin metal sheath to the $D_2O$ which is travelling parallel to the uranium cells in a vertical direction. After passing through the steam generators the $D_2O$ is forced upward through the fuel channels and between these channels. To serve as a moderator the $D_2O$ travels relatively slowly between the fuel channels and is discharged from the reactor through the control rod assemblies. The maximum surface temperature of the fuel cells is 465 deg. Fah. when the outlet temperature of the heavy water from the reactor is 440 deg. Fah.

Provision is made in the design for a helium blanketing system wherever there is an interface in the heavy water circuit—for example, in the reactor sphere outside the cylinder, and above the heavy water in the dump tanks and the make-up tank.

To reduce the length of piping, steam will be generated in three groups of boilers each consisting of six units, the whole being distributed in a close circle around the reactor. To minimise the effect of coolant hold-up in the piping a flow velocity of 25ft per second was decided upon.

The estimated reactor heat output is equivalent to 1064MW and each of the eighteen steam generators will produce 180,000 lb per hour of saturated steam at 180 lb per square inch abs and 373 deg. Fah. Each group of six boilers, arranged in three pairs, will supply steam to an 80MW turbo-alternator.

Of progress in atomic powered plants in Great Britain there is little that can be said except to summarise earlier official statements. The projects that have been announced include the building of two reactors for electricity generation and a "breeder" reactor in Caithness for a similar purpose.

## 275kV Supergrid

An important advance in the electric power interconnection and transmission system in Great Britain was inaugurated on July 15th last, when Sir John Hacking, the then deputy Chairman (Operations) of the B.E.A., opened the first section of the 275kV Supergrid. This 42-mile section which connects Staythorpe and West Melton was erected in advance of the main 275kV system to give operational experience. Unlike the rest of the system, it consists of a single circuit line, details of which were given in our issues of July 17th and 23rd.

It will be recalled that the 275kV Supergrid consists briefly of a central network of transmission lines covering the Midlands, Lancashire and the West Riding of Yorkshire and having a northerly connection to Clyde's Mill, Glasgow, via the north-east coast and Carlisle. There will be two main lines connecting the Midlands network with the London area—one from Staythorpe to Elstree and the other from Castle Donington to Iver, Bucks. At Elstree and Iver, respectively, these lines will be linked with a ring main encompassing the London area from Tilbury in the north-east, through West Weybridge, to Northfleet in the south-east. Another connection will link the Midlands (Hams Hall) with south-east England and South Wales, via Melksham (Wilts) and Uskmouth. Finally, there will be a connection from Melksham to the London area.

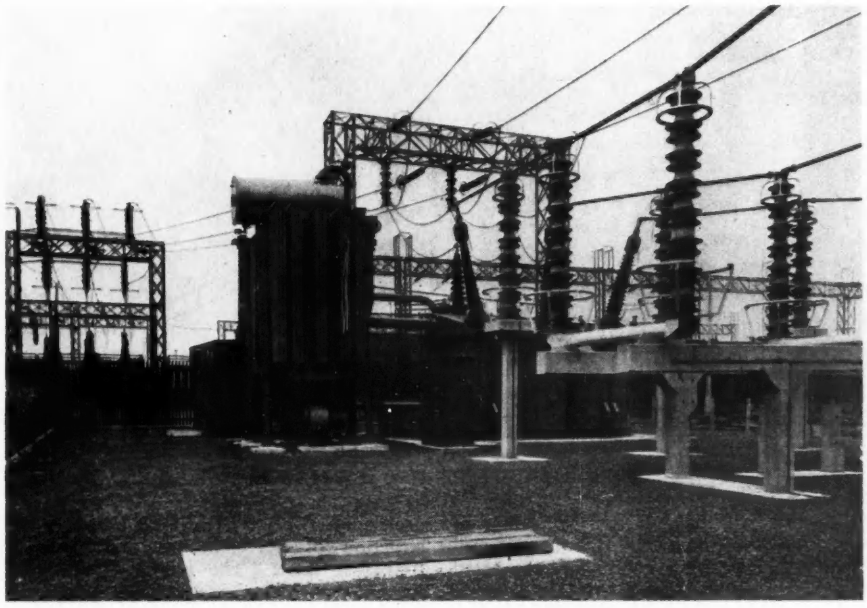


**Fig. 4—West Melton 275kV Substation**

The first section of this system to be completed and energised at 275kV connects Staythorpe power station, which is on the East Midlands coalfields, with West Melton, which serves as a marshalling point for power stations on the Yorkshire coalfields. Accordingly, the main function of this line is that of interconnection between power stations rather than that of bulk power transmission.

As already stated, it is a single-circuit

line. The three phases are strung horizontally at a spacing of 32ft 6in. Each phase consists of two steel-cored aluminium conductors, of 0·175 square inch equivalent copper section, at 12in centres and there are two earth wires.

The rest of the system will consist of double circuit lines. Two sizes of steel-cored aluminium conductor will be employed: the smaller, of 0·175 square inch equivalent copper section, will be used on those lines that are primarily for interconnection; the larger, of 0·4 square inch equivalent copper section, will be used on those lines that are intended for bulk transmission as well as interconnection. In both kinds of line each phase will consist of two conductors with a 12in spacing. The smaller conductors will have a thermal rating of 375MVA per circuit and the larger conductors 570MVA per conductor, compared with the original 132kV grid lines which had a corresponding rating of 90MVA per circuit. Normally each conductor of the twin 0·4 square inch line is suspended from eighteen cap-and-pin insulators with an overall length, including fittings, of 11ft 6in.

The experimental design of overhead line tower adopted for the Staythorpe-West Melton line was illustrated in our issue of July 17, 1953 (page 75) and a portion of a typical tower can be seen in Fig. 5, above.

For the rest of the 275kV system the lines are carried on double circuit towers similar to those of the 132kV grid, but with the necessary clearances for the higher voltage. To allow for future developments the towers on those sections of the line that are intended for bulk transmission are designed for operation, if required, at 380kV.

Auto transformers of 120MVA capacity are installed at points of interconnection between the 275kV and 132kV systems. These transformers are provided with on-load tap changing and they have a basic reactance of 15 per cent, to limit the short circuit input to the 132kV system, at a duplicate transformer station, to 1200MVA. The transformer at Staythorpe was made by the British Thomson-Houston Company, Ltd., and the one at West Melton, which can be seen in Fig. 4, by the English Electric Company, Ltd.

The substations at Staythorpe and West Melton are equipped for switching at 132kV with bulk oil circuit breakers having a short circuit rating of 2500MVA, and West Melton is also being provided with circuit breakers with a rating of 3500MVA.

To give service experience a three phase, 275kV English Electric air-blast circuit breaker has been installed on an experimental basis at the West Melton substation. A view of this circuit breaker is reproduced in Fig. 5. It consists of three identical single-pole units coupled together electrically and pneumatically. Each single-pole unit is built up of six interrupters connected in series and mounted in two vertical columns, each column being carried on a supporting structure of porcelain insulators with a triangular base. The interrupters are of axial blast design, shunted by porcelain-clad non-linear resistances. The two columns of single-pole units are connected by pneumatically operated double make-switch blades and an air jet is provided through the blades for ice-breaking purposes. The current transformers are separately mounted in oil-filled porcelain-clad enclosures.

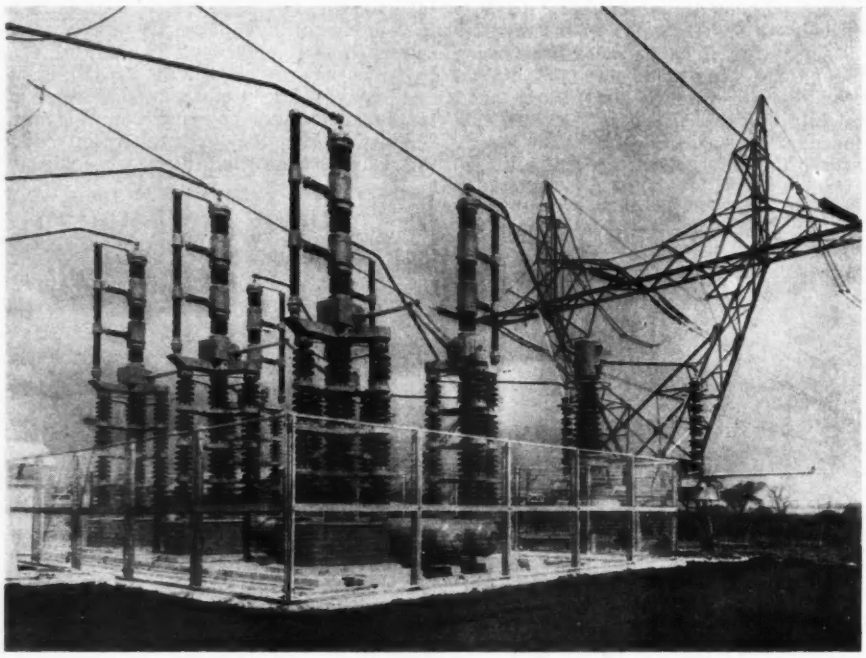


**Fig. 5—275kV Circuit Breakers at West Melton**

Compressed air is taken from the receivers in the base to the interrupters and make switch operating mechanisms, via support insulators. The air is stored at 600 lb per square inch in outdoor receivers and is fed by an automatic reducing valve at 300 lb per square inch through duplicate bus air pipes to the circuit breaker control cabinets, and thence through stop valves to the circuit breaker receivers.

### Cross-Channel Cable

Trials were carried out last summer to determine the practicability of laying a cable across the Channel to connect the high voltage supply systems of the British Electricity Authority and Electricité de France.

A test length of 0·5 square inch, gas-filled, 132kV, single core, submarine cable made by W. T. Glover and Co., Ltd., was paid out from the G.P.O. cable-laying ship "Alert," near Dover, and was floated ashore. There it was winched on to a shelf, anchored and connected to the test apparatus. A second half-mile length of identical cable made by the same manufacturer was laid the following week and connected in parallel with the first. A third length of cable, which was made by Tréfileries et Laminoirs du Havre to the Glover design, was laid later and connected to the common end of the other two cable lengths.

Under the control of the shore-based test plant the submerged cable lengths were subjected to a potential difference of 300kV, d.c., under a gas pressure of 250 lb per square inch. After these preliminary tests the cables were recovered and the joints examined.

This experimental work is the result of co-operation between W. T. Glover and Co., Ltd., British Insulated Callender's Cables, Ltd., and British Insulated Callender's Construction Company, Ltd., in collaboration with the British Electricity Authority under the direction of Mr. D. P. Sayers, deputy chief engineer (transmission) of the B.E.A.

### Electrical Manufactures and Exports

At the time of going to press there are no figures available to give a picture, in true perspective, of the production of electrical plant and apparatus in 1953. It is possible, however, to obtain some idea of general trends from a study of the annual report of the British Electrical and Allied Manufacturers Association for 1952–53. It is clear, for example, that the output of the industry as a whole was greater in 1952 than in 1951 and that direct exports in 1952 were valued at £218,000,000, an increase of 15 per cent over the figure for 1951, mainly accounted for by increases of £10,500,000 in electrical machinery and £8,500,000 in electric wires and cables.

Whether these rates of increase were maintained in 1953 is doubtful, but, on the basis of results for the first seven months of the year, it is evident that some headway was made in the case of control gear and heavy rotating machinery, both in total production and export. There was an increase in the production of heavy electrical generating plant, but not in the export of these items. With electric wires and cables the position in the first and second quarters was barely maintained.

The manufacturing industry was helped by the general improvement in the supply of raw materials: the return to private trading in copper will benefit the industry as a whole and the removal of restrictions in the use of nickel will assist the manufacturers of domestic appliances in their export trade. However, as these changes took place in the second half of the year, it is unlikely that their full effect will be reflected in the trading results for 1953.

It is evident, too, that the full weight of German and Japanese competition in export markets is yet to be felt. With the help of shorter delivery periods and favourable terms of payment, Germany was able to increase her electrical exports by 59·3 per cent, from £56,300,000 in 1951 to £89,000,000 in 1952. Japanese electrical exports amounted to £8,600,000 in 1952 compared with £5,400,000 in 1951, which suggests that Japanese competition represents a future threat rather than a present reality.

In the present review of the activities of British electrical manufacturers in 1953 it is impracticable to cover the whole field in detail and we propose therefore to refer to some of the many interesting examples of work completed or in progress.

Beginning with heavy electrical plant, we

illustrate in Fig. 6 the partly wound stator of a synchronous condenser which was completed early in the year by Metropolitan-Vickers Electrical Company, Ltd., for the State Electricity Supply Commission of Victoria. This machine is designed for direct connection to the Supply Commission's 22kV busbars at the Malvern terminal switching station near Melbourne. Its main function will be to regulate the voltage of the 22kV system ; it may also be used for charging the main 220kV transmission line. For these duties the synchronous condenser is rated at 40MVA at zero leading power factor in the over-excited condition and

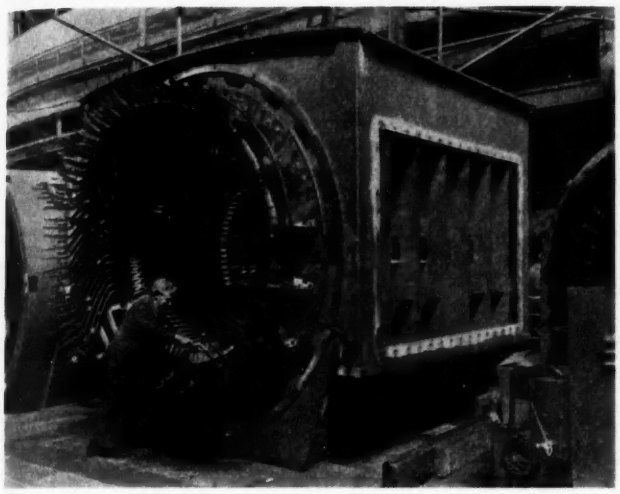


Fig. 6—Stator of 40MVA Synchronous Condenser for Australia

25MVA at zero leading power factor in the under-excited condition.

The set has closed-circuit ventilation with water-cooled air and, as described in our issue of March 6, 1953, page 361, the machine is unusual in that it is designed to be handled for erection and maintenance without the use of a crane, despite the fact that the rotor weighs 61 tons and the stator 54 tons. Accordingly, the set is arranged for installation on a concrete plinth raised 30in above floor level, and the air coolers are mounted on the two sides of the stator frame ; the position of one of the coolers can be deduced from Fig. 6. With this arrangement it is possible to erect or dismantle the set by moving the stator and rotor on rollers with the help of jacks, winches and a 3-ton portable crane for handling the smaller details, as described in the article referred to above. Substantial economies were made in building costs by dispensing with the need for a heavy crane and by eliminating the usual basement and reducing the excavation to the amount needed for the lubricating oil tanks.

When the equipment is operated as a motor generator set for charging the transmission line the synchronous condenser is driven by a 1160 h.p. synchronous induction motor which carries its own overhung exciter and is supplied from the 2·2kV busbars in the substation.

The same motor serves to start the set as a synchronous condenser. Starting up follows normal procedure for an induction motor with an external resistance. A fixed value of excitation is then applied to the motor field and the machine runs at synchronous speed. Next the condenser is excited to generate the required system voltage. Finally, to prepare the condenser for switching on to the 22kV system, the phase relationship between the supply voltage to the motor and the generated voltage of the condenser is adjusted. This phasing-out adjustment is effected not by the normal method of rocking the stator but by producing electrical displacement of the rotor field, making use of a method described in the above-mentioned article.

### Electronically Controlled Paper-Making Sectional Machine Drive

A good example of progress in industrial electrical drives is illustrated in Fig. 7, which gives a view of a paper-making machine supplied by James Bertram and Son, Ltd., Edinburgh, and installed at the mill of the Guard Bridge Paper Company, Ltd., near St. Andrews. This machine is designed to produce a variety of fine writing papers. It has a wire width of 122in and an operating speed range of 40ft to 400ft per minute. The machine is of particular interest because of the electronically controlled sectional drive, designed and supplied by the British Thomson-Houston Company, Ltd.

The machine consists of seventeen independently driven sections, which include a suction couch roll, two wet presses, dryers, a size vat, a spar cylinder, smoothing rolls between two dryer sections, five calenders and two tensioning reels. The motor side of the calender section is shown in Fig. 7.

Each section is driven by a forced-ventilated geared, d.c. motor with constant excitation. Speed control is obtained by supplying each motor armature from a separate Ward-Leonard generator which is excited by a grid-controlled bi-phase thyratron rectifier. A small tacho-generator is coupled to each section motor and generates a voltage proportional to the section speed. This voltage is compared with the voltage of a reference busbar and the difference is applied to a valve amplifier which controls the firing of the generator field thyratrons.

This system constitutes a feed-back regulating loop and the amplification is high enough to ensure that the difference between the feed-back voltage from the tacho-generator and the reference voltage is kept very small. Since the reference voltage is common to all the sections it follows that the speeds of these sections are co-ordinated throughout the machine. Rapid response is a characteristic of the speed regulating action, which is devoid of mechanical movement and associated inertia effects. The sensitivity of regulation is such that the speed change between sections from all causes, including load and temperature fluctuations, is less than 1 per cent.

To make the accuracy of speed regulation independent of variations in the supply voltage and frequency, stable d.c. and a.c. supplies are obtained from an exciter and alternator, each being controlled by its own electronic voltage regulator to within $\pm 0{\cdot}2$ per cent. The exciter energises the motor field windings and the contactor control gear and provides a 300V d.c. supply for the electronic regulators. The alternator generates the 480V a.c. power required by the electronic control equipment.

The machine is provided with master and section controls. By depressing push buttons on a master control pedestal the speed of the machine as a whole can be changed at a slow, controlled rate.

At each section of the machine there is a control station housing an " Inch " push button, a " Crawl-Off-Run " control switch, and a draw-control hand-wheel with a graduated scale. As long as the " Inch " push button is depressed the section drive runs at a slow preset speed. By setting the switch to " Crawl " the section can be kept running at the same slow speed. When the switch is set to " Run " the section accelerates uniformly until it reaches the paper-making speed as determined by the master speed control and the section draw control. Operation of a standard draw control hand-wheel adjusts the speed of the section concerned. There is also a draw control switch whereby a gradual change can be effected, simultaneously, in the section concerned and in all the subsequent sections.

( *To be continued* )

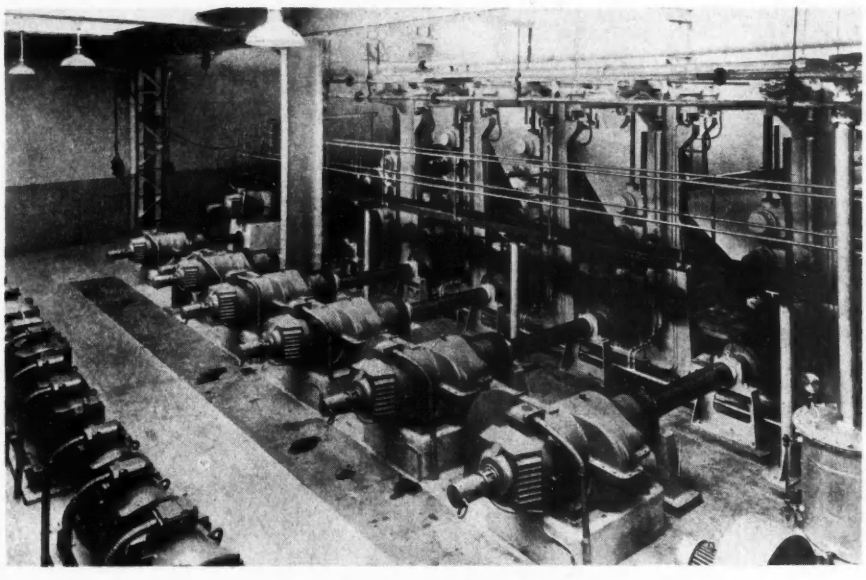


Fig. 7—Sectional Paper-Making Machine Drive

# British Iron and Steel Industry in 1953

No. II—( *Concluded from page* 28, *January* 1*st* )

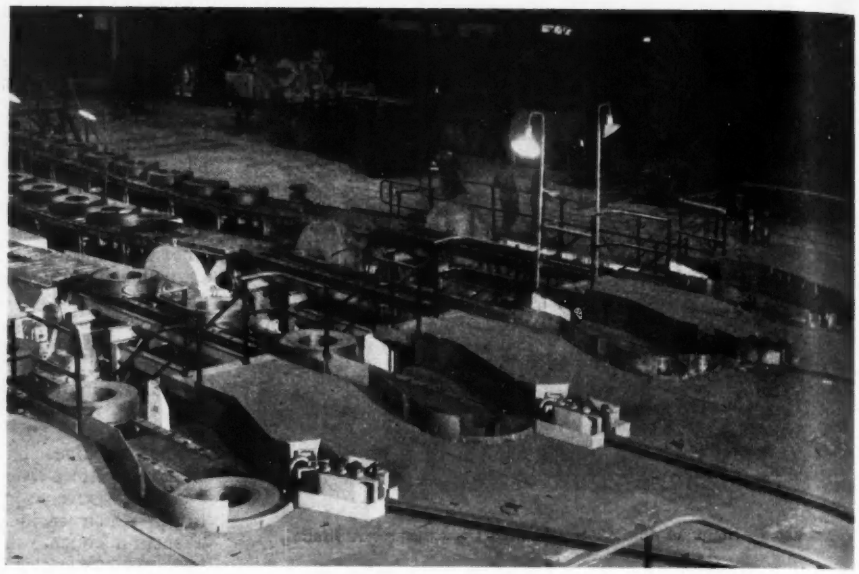
IN its final report, the Iron and Steel Corporation of Great Britain stated that the capital expenditure during 1953 by the then publicly-owned iron and steel companies had been estimated at £60,000,000. It was indicated, at the same time, that expenditure might need to continue at that rate for at least two further years. Work on the completion of the first post-war development programme was in progress during some part of last year in all the steel-making areas of the United Kingdom.

In our last issue we referred to two extensive development projects, one on the North-East Coast, and the other in the north-west. The development work carried out in other parts of the country last year included the completion of much of the modernisation at the Normanby Park Steel Works of John Lysaght's Scunthorpe Works, Ltd. In previous reviews of this nature, we have recorded the progress of this scheme, which is based upon a weekly pig iron output of between 7000 and 7200 tons, and an ingot capacity of 10,500 tons a week to produce blooms, slabs, billets and sheet bar. By the end of 1952, the work of extension and modernisation in connection with ore treatment and sintering, blast-furnaces, hot blast stoves, the melting shop, soaking pits and rolling mills had been completed. There remained for completion and commissioning in 1953 a steam and power scheme which has entailed the remodelling of the main services. The new installation includes three Foster Wheeler high-pressure boilers, each evaporating 80,000 lb per hour M.C.R. at 625 lb per square inch using blast-furnace gas. Two new turbo-alternators of 5000kW rating have also been installed, operating at 625 lb per square inch steam pressure and passing out steam at 160 lb per square inch to the existing 2000kW turbo-alternators and turbo-blowers. Richardsons, Westgarth and Co., Ltd., has been responsible for the installation of the new power plant.

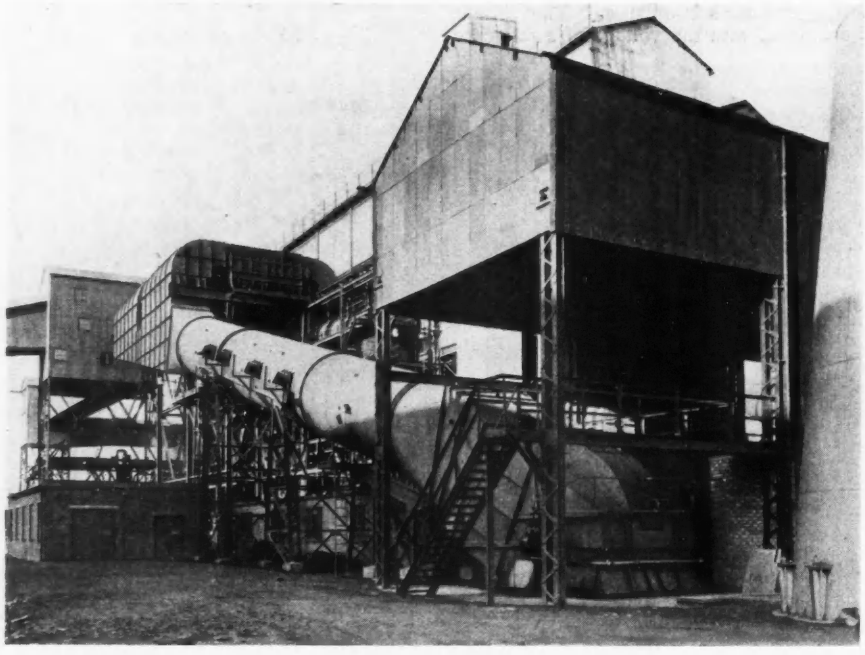
Good progress was also made last year at the Normanby Park Works with the construction of a fourth battery of coke ovens, and a new coal blending and conveying plant. It is anticipated that the No. 4 battery of twenty-three coke ovens will be operating during the coming summer. This will enable the company to make arrangements for rebuilding its No. 1 battery, consisting of forty-seven ovens, which has been in production since 1931. The rebuilding is being planned in two stages. For a start, twenty-six ovens will be wrecked and a division wall built to allow the remainder to continue operating as a battery of twenty-one ovens, the second stage being the rebuilding of twenty-three ovens from pad level. When this rebuilding is finished there will be one battery of twenty-one ovens and four batteries of twenty-three ovens, an arrangement which will permit the rebuilding of oven batteries to be undertaken in rotation as necessitated by the condition of the oven brickwork.

Since the end of the war, Stewarts and Lloyds, Ltd., has had in hand an extensive programme of development at its various works. At Corby, last year, work continued on the construction of the No. 5 battery of seventeen Becker coke ovens. Each oven chamber has an average width of 16in with 2in taper, and is 13ft high by 40ft 8in long, face to face of doors. Four 16in diameter charging holes are provided and there are two 15½in gas off-takes for use in conjunction with a double collecting main system. The regenerator chambers are 12ft 0½in high by 40ft 9⅜in long, inside walls, and are divided into two compartments. Provision has been made for either coke oven or blast-furnace gas firing. The coke oven plant at Corby now consists of five batteries, totalling 141 ovens, and is 1150ft between quenching stations. As the new battery is intended for replacement purposes, no provision has been made for handling increased coke production, but to reduce the heavy burden on the coke quenching cars, a second coke wharf, 160ft in length and having a sloping surface 25ft wide, has been constructed. This wharf also incorporates a " bought " coke wharf and a wagon tippler. As part of the coke oven plant at Corby, a sulphuric acid plant, with a capacity of 35 tons a day, has recently been put into operation. The plant produces acid from hydrogen sulphide, which is recovered from coke oven gas, and which is subsequently converted into sulphuric acid in a wet contact plant.

Another development at Corby is the installation of a fourth sintering plant, which has a capacity of 1200 tons a day. The new plant is of Dwight-Lloyd design with nineteen wind boxes, the strand consisting of 143 pallets and 133ft driving sprocket centres. The extraction fan is of backward



Strip Coilers at Corby



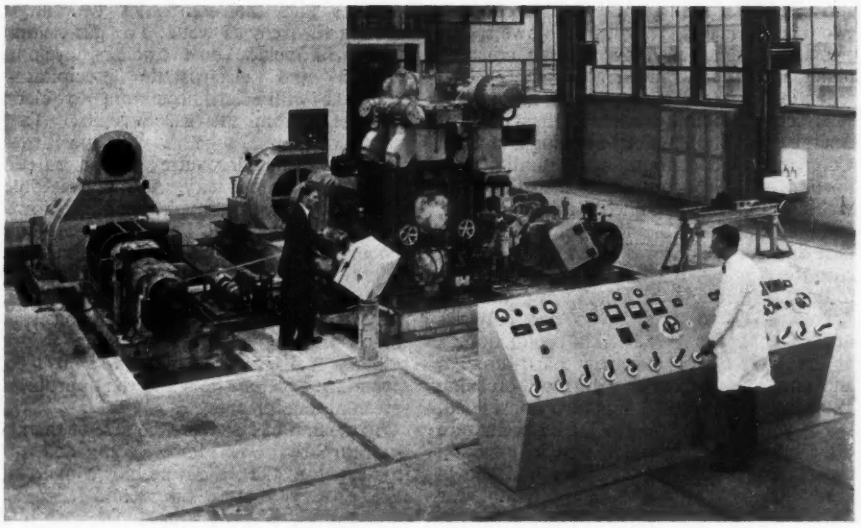
Sinter Plant at Corby

curve blade design and has a capacity of 200,000 cubic feet per minute, giving a suction of 27in w.g. It is directly coupled to a 1550 h.p., 3000V a.c. motor, speed variation being achieved by a remotely controlled liquid starter. In this sinter plant atmospheric pollution is effectively controlled by the introduction of two banks of " Centicell " dust extractors into the exhaust gas main leading to the fan. One of our illustrations shows a general view of the plant with the dust extraction equipment. The discharge of the sinter is, first, over fixed bar screens, the furnace material being discharged into wagons, and then over vibrating screens which separate return fines from hearth layer material. The hearth layer material is returned to the machine in measured quantities by a rotating table feeder.

A major item in the developments at Corby is the installation of the new No. 1 strip mill which replaces the old Schloeman mill. It is designed to produce high quality strip for the manufacture of continuous weld and electric resistance weld tubes. This 19in straight continuous mill has twelve horizontal two-high and eight edging stands of Morgan design, each stand being driven individually. The mill has a capacity of 500,000 to 600,000 tons a year, producing strip in sizes from 6·782in to 15·350in wide and gauges from 0·092in to 0·280in. "Morgoil" bearings are used throughout and the equipment includes a specially designed lubricating oil pumping and conditioning plant. In conjunction with the mill, two triple-zone slab heating furnaces have been provided, each capable of heating 70 to 100 tons of steel an hour, depending on the slab size and ratio of hot/cold stock charged. The furnaces are suitable for slabs varying in length from 19ft to 21ft and from 3in to 4in thick, with a maximum weight of 3400 lb. On leaving the mill, the strip is twisted on edge and discharged on to either of two apron conveyors, the selection being controlled electronically. Each of these conveyors feeds two vertical Morgan coilers, which can be seen in one of our illustrations. Finally, there is a horizontal roller conveyor system to transfer the coiled strip to stocking areas.

At its works at Bilston, in Staffordshire, Stewarts and Lloyds, Ltd., has two development projects in hand. One of them is the complete reorganisation of the open hearth scrap handling facilities, and the other is the construction of a new blast-furnace and its ancillary plant. The open hearth scrap handling facilities are being reorganised in order to speed up furnace charging operations. The work involves the resiting of two scrap gantries and the installation of two large baling presses, the reconstruction of the open hearth plant platform to make it suitable for locomotive traffic, and the construction of a concrete approach ramp between the scrap yards and the furnace platforms.

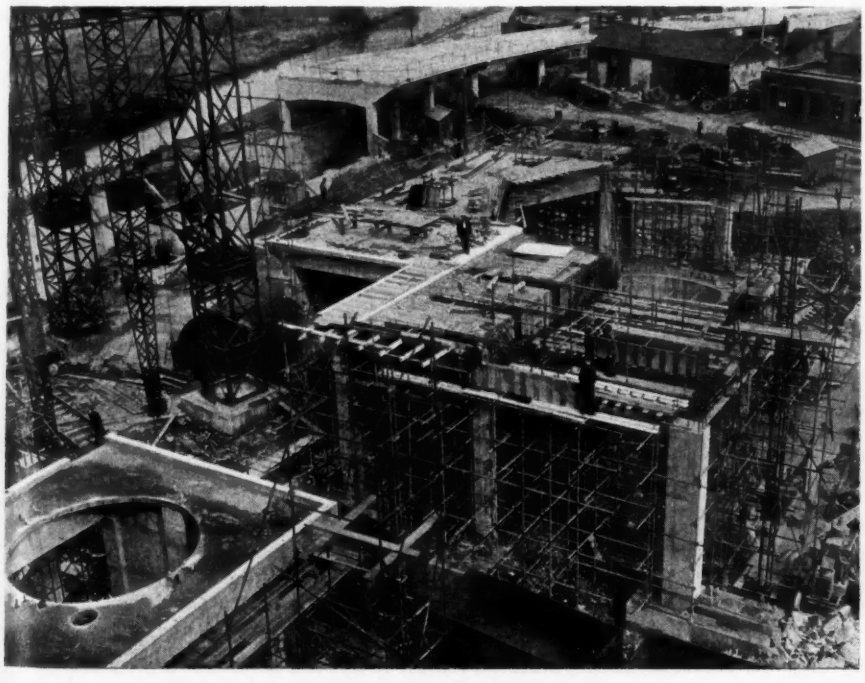
The new blast-furnace has a hearth diameter of 21ft 6in and is designed for pressure operation, the blowers serving the furnace having a maximum capacity of 75,000 cubic feet of air per minute and a maximum pressure of 45 lb per square inch. The gas cleaning plant consists of three gas washing towers and electrostatic precipitators, and the project also makes provision for 2500kW of additional generating capacity and a complete water treatment and circulating plant. One of the photographs which we reproduce shows the progress which had been made during last year on the foundation work for the blast-furnace and gas cleaning plant.



**Rolling Mill at B.I.S.R.A. Laboratories**

At its Tolcross Works, Glasgow, Stewarts and Lloyds, Ltd., is constructing a new steel foundry, to replace the present foundry at Coatbridge, which has been in operation since 1906. The new foundry will be housed in one main block of buildings, with a separate block to include the laboratory and " amenities " buildings. The main building is 550ft long by 150ft wide, and consists of three parallel bays 500ft long, with a 50ft bay across one end of these three bays. incoming scrap will be off-loaded and stored by crane in this cross bay, which will also house two melting furnaces. They are 3-ton electric arc furnaces, with swing roofs, each furnace being rated at 2000kVA. The hot metal will be transferred by bogie into either of two of the 500ft long bays for casting. The casting area is concreted, and all casting will be in boxes either on the floor or in casting pits. The sand handling has been mechanised wherever possible. A specially designed crane will empty the sand from incoming wagons directly into storage hoppers and the sand will be distributed to the moulding area by underground belt conveyors. The placing of the sand in the moulds will be by machine, and conveyors or cranes will be used to assist handling wherever possible. On cooling, the sand will be knocked out of the moulds at mechanical " knock out " stations in the floor, the used sand again being carried by underground conveyors to the sand treatment plant. Gas-fired furnaces and quenching tanks are being installed for the heat-treatment of castings, and two " Wheelabrators " will be used for cleaning the castings. A machine shop is also included to deal with rolls for the tube mills and for finishing castings where required. A specially constructed compound is being constructed within the building to enable castings to be inspected with gamma-ray isotopes.

The third 500ft bay will house the ancillary



**Foundations for Blast-Furnace and Gas Cleaning Plant at Bilston**

services for the foundry, such as the core shop, sand preparation mills, pattern shop and stores area. Special attention is being paid throughout to the elimination of dust.

The Appleby-Frodingham Steel Company (which is a branch of the United Steel Companies, Ltd.) continued throughout last year with the iron works development which is in progress at Scunthorpe, Lincolnshire. The project, work on which was started early in 1952, includes the construction of two blast-furnaces, four turbo-blowers, gas cleaning plant, clariflocculators, crushing plant and four-strand sinter plant. The reduction in recent years in the amount of steel scrap becoming available has made it desirable for the Appleby-Frodingham Steel Company to contribute a substantial proportion of its iron output to keep the other melting shops of the United Steel Companies, Ltd., at a reasonable level of production. One of the first decisions taken in connection with the Appleby-Frodingham project, therefore, was to double the coke oven plant, and for the last two years or so two batteries of sixty-six ovens have been in production.

The building of two new blast-furnaces and ancillaries, together with more crushing and sintering capacity, was also considered, but it was felt that this might be premature until research work which was in hand on the making and using of sinter had shown more positive results. The decision was therefore taken to build two new sinter machines and to modify the existing two sinter machines to the same standard, and then to conduct full-scale experiments before embarking on any further plant development. The new sintering equipment came into operation early in 1951, and it soon became apparent that more knowledge of the theory of manufacturing high-grade sinter from home ore fines was desirable. Intensive research was conducted in this direction and the findings were rapidly applied in practice in the plant, with the result that the output of sinter from the four strands has now been considerably increased. The quantities of sinter which are available have made it possible to experiment with the burdening of blast-furnaces to the extent of operating a furnace on a charge of coke and sinter only.

The results of its experimental work and changes in practice, together with the ever-increasing demand for iron produced from home ores, led the company to decide in the latter part of 1951 to proceed with its plans for the construction of two more blast-furnaces and blowing equipment, a new primary and secondary crushing plant, and four new sinter machines. The blast-furnaces are to be of 27ft and 28ft 6in hearth diameters respectively. The blowing equipment will consist of blast-furnace gas-fired boilers and steam-turbine-driven centrifugal blowers, sufficient to blow the two new furnaces and the company's two largest existing furnaces as well. The gas-cleaning plant will include dust catchers, cyclones, washers and electrostatic precipitators, equipped with clariflocculators to clarify the water from the gas washers. These plants, of course, together with the furnace cooling system, will require a large circulating water cooling capacity, and a reinforced concrete natural draught cooling tower, 180ft diameter at the base and 285ft high, is being built. It will be subdivided into three separate zones to deal with the different kinds of circulating water. The crushing plant which is to be built will consist of wagon tippling equipment feeding a large primary roll crusher, followed by two secondary cone crushers and the appropriate screening equipment.

By the end of last year, the first of the new blast-furnaces was almost completed and it is expected that it will be blown in by the middle of February ; the second furnace is now about half completed. The hot blast stoves are erected, and that portion of the gas cleaning plant which serves the first blast-furnace is also complete. One of the four new turbo-blowers is now in use, and the crushing plant and most of the sinter plant are ready for operation.

### Research

In this review we have referred to a few of the development and extension schemes upon which work was proceeding last year. There are several other projects in all the steel-making areas of this country, all of them having been designed to increase the efficiency of the industry. In recent years, in particular, the British iron and steel industry has derived increasing benefit from the research work undertaken by individual firms and by the British Iron and Steel Research Association. An event of outstanding importance last year, so far as the work of B.I.S.R.A. is concerned, was the opening on November 19th of its new laboratories at Sheffield. The Association's researches into the making, working and metallurgy of steel are being concentrated in these laboratories, the cost of which so far has amounted to about £500,000. The laboratories, which consist of four new and three older buildings, constitute a miniature steel works housing pilot machinery for the melting, rolling, drawing and forging of steel. As an example of the equipment of the laboratories, we illustrate the high-speed reversible four-high cold strip mill which has been supplied by W. H. A. Robertson, Ltd., Bedford, the electrical work being carried out by Metropolitan-Vickers Electrical Company, Ltd. The mill accommodates work rolls from 3½in to 7in diameter, the back-up rolls are 14½in diameter, and all rolls have a face width of 14in. Screwdown is by two 5 h.p. motors, operated independently or together, the total design load being 300 tons. The main mill motor has a maximum continuous output of 750 h.p. and each coiler is equipped with a 200 h.p. motor. A full description of the laboratories was printed in our issue of November 27, 1953.

## B.E.A. Generating Plant Installed in 1953

A STATEMENT by the British Electricity Authority shows that new generating plant installed by the Authority during 1953 yielded an additional output capacity of 1413MW, details of which are tabulated herewith. The total of 1413MW compares with 1539MW in 1952 and 1113MW in 1951. The additional plant, comprising thirty-one turbo-generators with an aggregate installed capacity of 1518MW and sixty-eight boilers having an aggregate evaporative capacity of 19,725,000 lb per hour, was installed in thirty-four of the Authority's power stations. Eight of these are new stations in which plant has been installed for the first time, as indicated in the table by an asterisk. The Authority planned to commission between 1300MW and 1500MW of plant in 1953 ; the actual result of 1413MW is just above the mean of these figures.

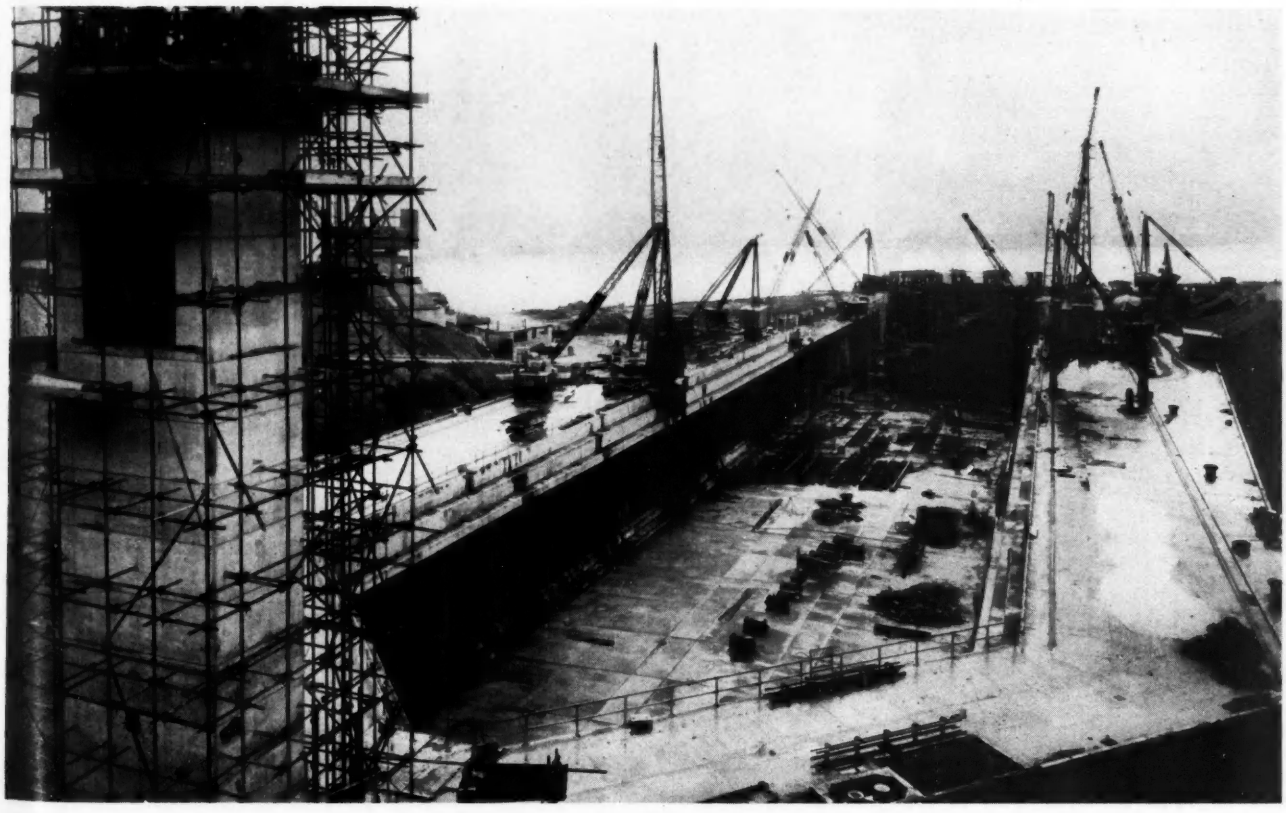
The British Electricity Authority points out that to meet the winter peak demand, the aim each year is to commission the maximum amount of plant by December 31st, and that as a result of strenuous efforts by the Authority's construction staff, building contractors and manufacturers, some plant has been installed in advance of its scheduled date of completion.

*Generating Plant Commissioned by British Electricity Authority in* 1953

| Name of power station | B.E.A. Divisions | Turbo-generator plant | | Boiler plant | | Main high-pressure pipework |
|---|---|---|---|---|---|---|
| | | Installed capacity in MW | Maker | Capacity in lb/hr | Maker | Maker |
| Bankside | London | 1 × 60 | British Thomson-Houston | 2 × 375,000 | Foster-Wheeler | C. A. Parsons |
| Barking "C" | London | 1 × 75 | British Thomson-Houston | 3 × 405,000 | Babcock and Wilcox | Aiton |
| Battersea "B" | London | 1 × 100 | Metropolitan-Vickers | 1 × 425,000 | Babcock and Wilcox | Aiton |
| *Bold "A" | Merseyside and North Wales | 1 × 30 | Metropolitan-Vickers | 1 × 300,000 | Yarrow | Aiton |
| Braehead | South West Scotland | 1 × 50 | C. A. Parsons | 1 × 300,000 | Babcock and Wilcox | Babcock and Wilcox |
| Brighton "B" | South Eastern | 2 × 52 | Richardsons, Westgarth | 3 × 320,000 | Babcock and Wilcox | C. A. Parsons |
| Bromborough | Merseyside and North Wales | — | — | 2 × 300,000 | Babcock and Wilcox | Stewarts and Lloyds |
| Brunswick Wharf | London | 1 × 52·5 | Metropolitan-Vickers | 2 × 320,000 | Clarke Chapman | C. A. Parsons |
| *Carmarthen Bay | South Wales | 2 × 52·5 | Metropolitan-Vickers | 5 × 240,000 | Babcock and Wilcox | Stewarts and Lloyds |
| *Carrington | North Western | 1 × 60 | Metropolitan-Vickers | 3 × 360,000 | Babcock and Wilcox | Stewarts and Lloyds |
| *Chadderton | North Western | 1 × 60 | Metropolitan-Vickers | 1 × 360,000 | Simon-Carves | Stewarts and Lloyds |
| Clarence Dock | Merseyside and North Wales | 1 × 51·5 | Metropolitan-Vickers | — | — | Stewart and Lloyds |
| *Connah's Quay | Merseyside and North Wales | 1 × 30 | C. A. Parsons | 1 × 300,000 | International Combustion | John Tompson |
| Croydon "B" | South Eastern | — | — | 1 × 320,000 | Simon-Carves | Aiton |
| Deptford East | London | 1 × 52·5 | Metropolitan-Vickers | 2 × 250,000 | Foster-Wheeler | John Thompson |
| *Doncaster | Yorkshire | 1 × 30 | General Electric | 3 × 180,000 | Mitchell | Aiton |
| *East Yelland | South Western | 2 × 30 | C. A. Parsons | 4 × 180,000 | John Thompson | C. A. Parsons |
| Huddersfield | Yorkshire | 1 × 30 | General Electric | 1 × 180,000 | Bennis | C. A. Parsons |
| Huncoat | North Western | — | — | 1 × 305,000 | Simon-Carves | C. A. Parsons |
| Keadby | Yorkshire | 1 × 60 | C. A. Parsons | 1 × 550,000 | Stirling Boiler Co. | C. A. Parsons |
| Littlebrook "C" | South Eastern | 2 × 60 | C. A. Parsons | 3 × 360,000 | International Combustion | C. A. Parsons |
| Nechells "B" | Midlands | 1 × 52·5 | C. A. Parsons | 4 × 230,000 | International Combustion | Stewarts and Lloyds |
| North Tees "C" | North Eastern | 1 × 60 | C. A. Parsons | 3 × 360,000 | Babcock and Wilcox | Babcock and Wilcox |
| Poole | Southern | — | — | 2 × 300,000 | International Combustion | Aiton |
| *Roosecote | North Western | 2 × 30 | Metropolitan-Vickers | 2 × 300,000 | Yarrow | Aiton |
| Rotherham | Yorkshire | — | — | 1 × 200,000 | International Combustion | Stewarts and Lloyds |
| Rye House | Eastern | 2 × 32 | Richardsons, Westgarth/C. A. Parsons | 2 × 350,000 | Babcock and Wilcox | Stewarts and Lloyds |
| Skelton Grange | Yorkshire | — | — | 1 × 360,000 | International Combustion | Aiton |
| Staythorpe | East Midlands | 1 × 60 | British Thomson-Houston | 2 × 240,000 | Babcock and Wilcox | Aiton |
| Thornhill | Yorkshire | — | — | 2 × 180,000 | Mitchell | Stewarts and Lloyds |
| Uskmouth | South Wales | 1 × 60 | General Electric | 3 × 360,000 | Babcock and Wilcox | Aiton |
| Walsall | Midlands | — | — | 3 × 180,000 | Babcock and Wilcox | Aiton |
| West Ham | London | — | — | 1 × 180,000 | John Thompson | Aiton |
| Westwood | North Western | 1 × 30 | British Thomson-Houston | 1 × 300,000 | Babcock and Wilcox | Stewarts and Lloyds |
| | Totals | 1518MW | — | 19,725,000 lb/hr | | |

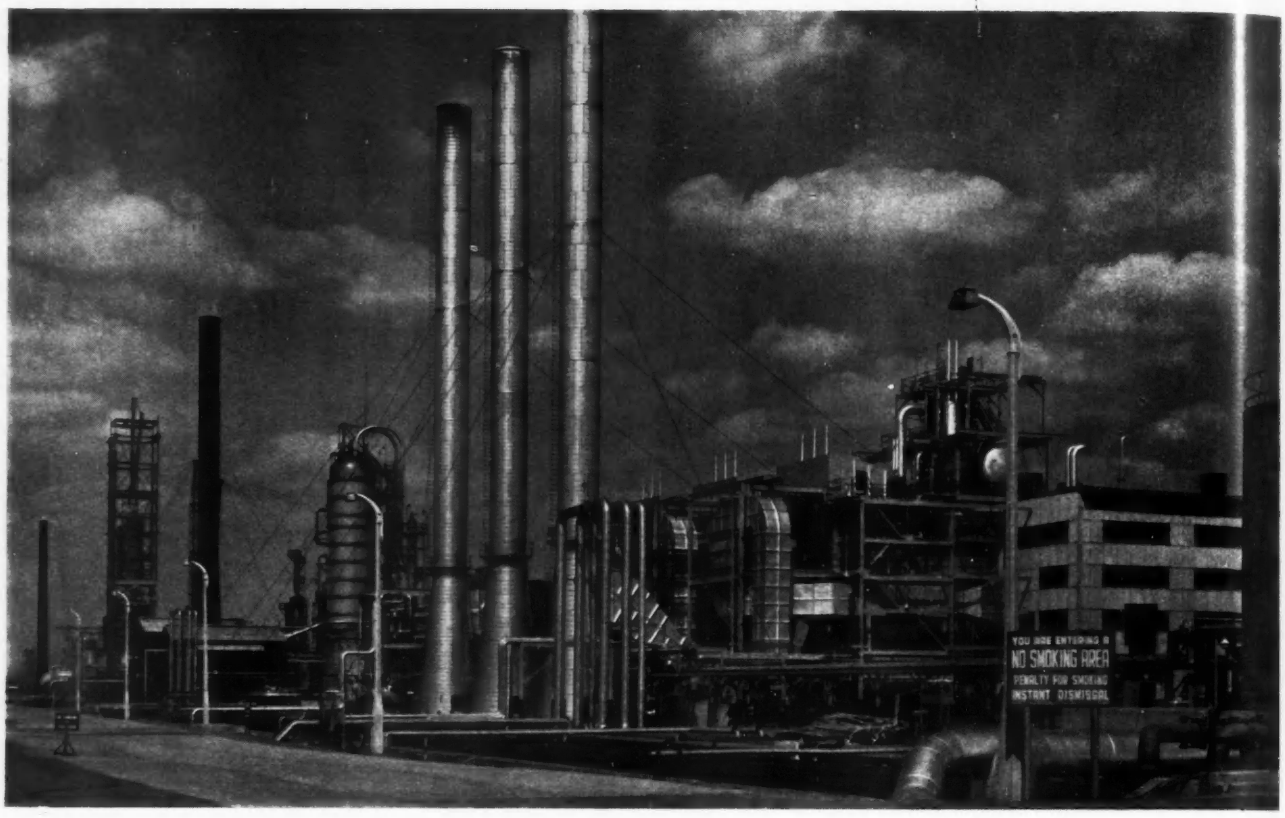
# CIVIL ENGINEERING IN 1953

Civil Engineering Works at Marchwood Generating Station

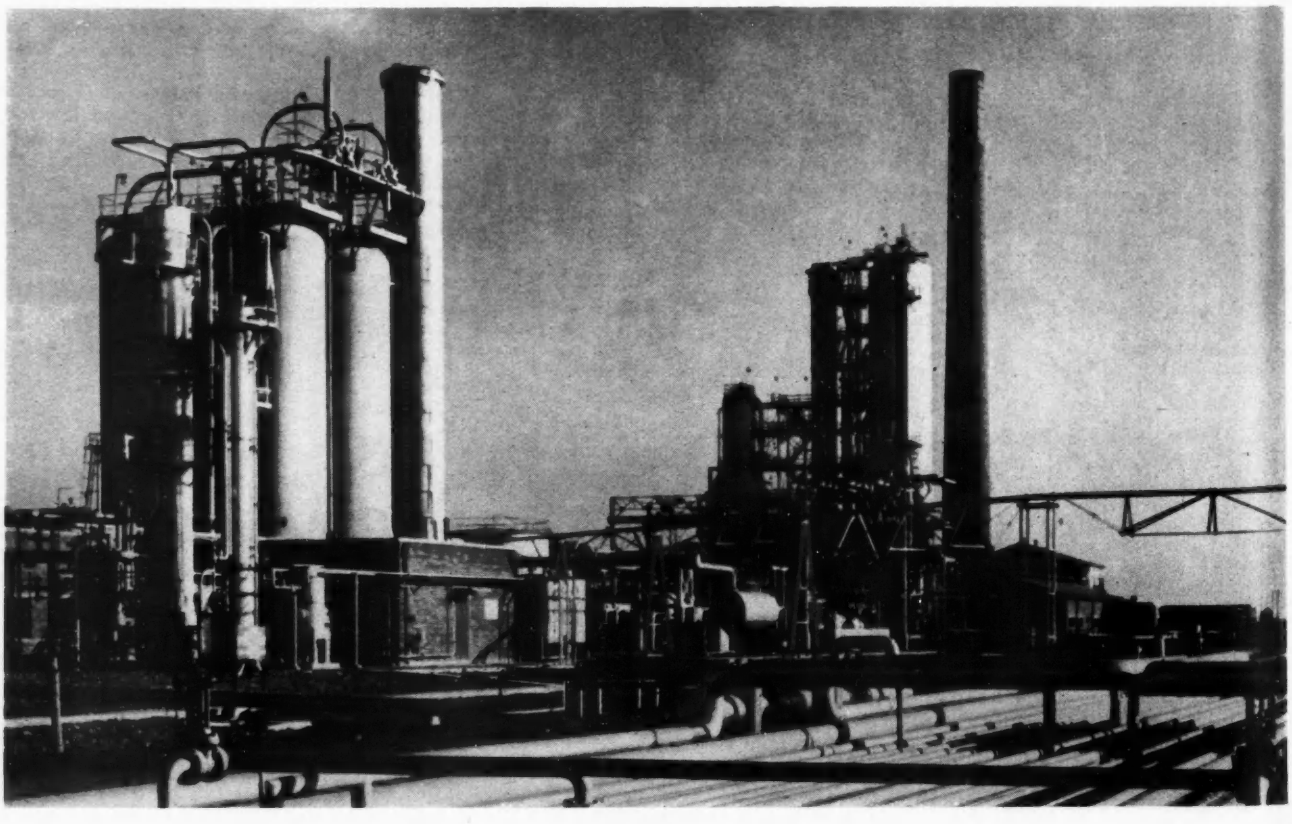


Construction of Dry Dock at North Shields

# OIL REFINERIES OF 1953




Coryton Refinery



Kent Refinery

# Naval Construction in 1953

By RAYMOND V. B. BLACKMAN

No. II—( *Continued from page* 33, *January 1st* )

### Survey Ship

IN Fig. 5 we illustrate H.M.S. " Vidal," the largest vessel built from the keel up as a survey ship for the Royal Navy, and finally completed at the end of the year. Laid down on July 5, 1950, and launched on July 31, 1951, she is the first survey ship to be equipped with a helicopter flight deck. Since the war frigates have been converted during the building stage into survey ships, but the " Vidal," the first of a new type, was from the start designed by the Admiralty for hydrographic surveying and chart production. H.M. Dockyard, Chatham, was responsible for both her hull and main machinery. With an overall length of 315ft, a length between perpendiculars of 297ft, and a beam of 40ft, she has a standard displacement of about 2000 tons. She has a hangar and a deck arrangement designed to make possible the flying off and landing on of a helicopter, the purpose of which is for air survey photography and the transport of parties to shore observation stations. The after end of the forecastle deck extension is a landing apron for the helicopter, which is housed in the after deckhouse hangar on the same level. The fore part of the bridge and the funnel are pear shaped in plan. The ship will carry three surveying motor launches equipped with echo-sounding apparatus. She is the first British naval vessel to be equipped from the beginning for cafeteria messing.

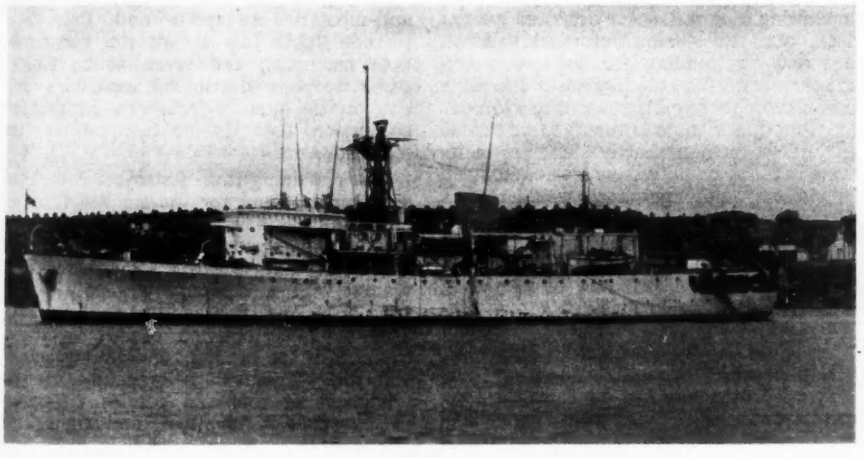


**Fig. 5—Survey Ship H.M.S. " Vidal "**

The main propelling machinery of the " Vidal " consists of four diesel engines driving two shafts through reverse and reduction gearboxes. These engines were designed at H.M. Dockyard, Chatham, in conjunction with the Admiralty Engineering Laboratory and the Engineer-in-Chief's Department of the Admiralty, and manufactured in H.M. Dockyard, Chatham. The latest electronic aids to surveying and navigation are incorporated, and there is a large process camera and a lithographic printing press to enable the results of surveys to be reproduced on board. Electrical power is provided from 360kW, 220V d.c. diesel-driven generating sets. Among the special features of the ship is her air-conditioning plant installed to make her living spaces, working spaces and offices comfortable in all climates from the Equator to the Poles. Operating on the reversible heat pump principle, this 750,000 B.Th.U. per hour plant is capable of heating or cooling the ship.

### Royal Yacht

The new Royal Yacht/small hospital ship " Britannia," which was laid down at the Clydebank yard of John Brown and Co., Ltd., in June, 1952, was launched on April 16, 1953, when she was named by Her Majesty the Queen, and by the end of the year the ship had carried out trials. The " Britannia " has a load displacement of about 4000 tons with an overall length of 413ft and a water line length of 380ft, a beam of 55ft, and a moulded depth of 32ft 6in. The maximum draught in any seagoing condition will not exceed 16ft. The vessel is of Admiralty design, but she was built to conform to the rules of Lloyd's Register of Shipping—that is, mercantile practice was followed in her construction. She is well subdivided and power-operated watertight doors are provided on the lower deck where transverse sub-division bulkheads are pierced. In addition to the normal fire-fighting arrangements, a sprinkler system is provided in the Royal and staff apartments. The entire structure above the water line is riveted. The ship is fitted with a stabiliser to reduce roll in bad weather.

Arrangements in the " Britannia " are such that the Royal Yacht could be converted into a small naval hospital ship with the minimum of structural alteration. The Royal and State apartments would be converted into hospital wards, operating theatres, &c., for which air conditioning has been fitted. The after end of the shelter deck is strong enough to allow a helicopter carrying patients to land on it. The main propelling machinery comprises single-reduction geared steam turbines fed by two boilers and driving twin screws to give the ship a continuous cruising speed of 21 knots. Special attention has been paid to the funnel design, experiments having been carried out to make the ship as free from smoke as possible. Aluminium alloy was used in the funnel as well as in part of the superstructure. The yacht has a modified cruiser stern and a raked bow, with a single funnel and three masts. There will be both a Decca navigator and navigational radar to assist her navigation. The distilling capacity of the ship will render her independent of shore fresh water supplies if necessary. Full water purification plant is fitted. The Royal apartments, on the shelter deck, and State apartments on the upper deck abaft the mainmast, are situated in the after part of the ship, while accommodation for the officers and ship's company is forward. The vessel is fitted out for cruising in both cold and tropical waters, and her endurance is sufficient to enable her to undertake long ocean voyages.

### Aircraft Carrier Conversion

Turning from new construction to reconstruction, work continued steadily in 1953 on the fleet aircraft carrier " Victorious," which is being completely rebuilt and actually constitutes the biggest warship reconstruction job ever undertaken in Great Britain. She was taken in hand in 1950 by H.M. Dockyard, Portsmouth, but her modernisation is so extensive and so many improvements are being incorporated in her (to keep pace with current and anticipated developments to enable her to operate the largest, heaviest and fastest naval aircraft) that she will not be ready for service until 1957, according to the latest estimates. She will be longer, wider, higher and heavier than before, and will be equipped with the new angled deck arrangement, the new steam catapults and a side lift. When her modernisation is completed she will at once be practically a new warship and a transformed aircraft carrier.

The " Victorious " was originally completed in May, 1941, by Vickers-Armstrongs, Ltd., Walker-on-Tyne, with engines by the Wallsend Slipway and Engineering Company, Ltd., when she had a nominal displacement of 23,000 tons and a full-load displacement of 29,110 tons, with a length of 751ft, a beam of 95ft 9in, and a draught of 29ft 3in. She was armed with sixteen 4·5in guns, seven 40mm anti-aircraft weapons, forty-four 20mm A.A. pieces, and forty 2-pounders, and she carried fifty-four aircraft. Six three-drum boilers and Parsons geared turbines turning three shafts and developing 110,000 s.h.p., gave her a speed of 31 knots. When she emerges from reconstruction, however, she will have a standard displacement of about 30,000 tons, increased to nearly 40,000 tons at full load, with a length of 766ft, a beam of 102ft, and a draught of 30ft; she will be armed with sixteen 4·5in guns and fifty 40mm Bofors A.A. guns, and she will carry seventy-two aircraft.

The light fleet aircraft carrier " Warrior," of 13,350 tons standard displacement (18,300 tons full load), completed a less extensive modernisation in H.M. Dockyard, Devonport, during the year. She now has a lattice mast and a taller bridge. The modernisation of the cruiser " Royalist," of 5900 tons standard displacement (7360 tons full load) was started.

### Destroyers to Frigates

The main effort of the conversion programme is directed towards turning fleet destroyers into fast anti-submarine frigates, thus providing a speedy supplement to the current rearmament programme of new construction anti-submarine frigates. Of the forty-five destroyers of the war emergency classes scheduled to be converted into fast

anti-submarine frigates thirty-four had been converted or were taken in hand for conversion by the end of 1953. These comprised two of the " O " class, two of the " P " class, four of the " R " class, eight of the " T " class, eight of the " U " class, five of the " V " class, four of the " W " class, and one of the " Z " class. It was originally intended that these converted ships would be divided into two types only, namely, those fully converted into specialised hunter-killer frigates, entailing complete reconstruction and leaving little resemblance to the original destroyer category, and those involving only limited conversion from destroyers into fast anti-submarine escorts, utilising the basic layout of the destroyer and preserving much of the original appearance of the orthodox destroyer ; but in 1953 it was decided to effect a third kind of reconstruction officially known as improved limited conversion, and the first vessel of this category to be taken in hand is H.M.S. " Troubridge," a destroyer leader of 1730 tons standard displacement and 2530 tons full load.

Fleet destroyers which were fully converted or taken in hand for large-scale reconstruction on similar lines to the prototypes " Rocket " and " Relentless " are the " Rapid," " Roebuck," " Grenville," " Ulster," " Ulysses," " Undaunted," " Undine," " Urania," " Urchin," " Ursa," "Venus," "Verulam," "Vigilant," "Virago," " Volage," " Wakeful " (Plate 1, Jan. 1st), " Whirlwind," " Wizard," " Wrangler " and " Zambesi." Taken in hand by H.M. Dockyards or under contract by various private yards, they were first dismantled, all superstructure, including bridges, masts and funnel, and armament comprising four 4·7in guns, eight to twelve smaller anti-aircraft weapons, and eight 21in torpedo tubes and upper deck equipment being removed, leaving no more than the forecastle and propelling machinery spaces. The ships were stripped down to the bare hull and were then rebuilt to an entirely new design. The forecastle deck was extended aft to the quarter deck and they were built up one deck higher amidships, extensive use being made of aluminium plating to reduce top weight. A new low-lying superstructure was built on with a semi-circular bridge front. A sturdy lattice foremast and a short lattice mainmast were stepped, equidistant between which a somewhat squat raked funnel was erected almost amidships. Two of the new ahead projecting triple-barrelled anti-submarine mortars of the improved squid design, arranged *en echelon*, were mounted in loading bays right aft in the extended shelter deck.

These fully converted fast anti-submarine frigates originally had standard displacements of 1705 to 1730 tons and full load displacements of 2425 to 2530 tons, with a length of 362ft 9in, a beam of 35ft 8in, and a maximum draught of 16ft. These destroyer dimensions have been retained, together with the original propelling machinery, which comprises two Admiralty three-drum boilers and Parsons geared turbines turning two shafts and aggregating 40,000 s.h.p., designed for a maximum speed of 36¾ knots and equal to a sea speed of 31¼ knots ; as frigates they are very fast. As well as the new anti-submarine weapons, the new armament of the " full conversion " type frigates includes two 4in dual-purpose guns in a twin mounting superfiring over the shelter deck and quarter deck, and two 40mm Bofors anti-aircraft weapons surmounting the forward superstructure just before the foremast. Provision is also made for two 21in fixed single torpedo tubes (and four torpedo tubes) to be carried on each beam immediately abaft the mainmast, but in some ships these are not mounted at present, although they would be in wartime.

In addition to the above twenty-two fast anti-submarine frigates of the full conversion, twelve destroyers have been or are being converted on a limited scale into fast anti-submarine frigates. The " Teazer," " Tenacious," " Termagant " (Fig. 6), " Terpsichore," " Tumult," " Tuscan " and " Tyrian " originally had the same displacement, dimensions, armament, propelling machinery and speed as the " R," " U," " V " and " W " classes mentioned above, and could have been reconstructed similarly, but in order to provide the Royal Navy with fast frigates of good anti-submarine qualities more rapidly than the process of full-scale stripping down to the bare hull and rebuilding afresh of the " Relentless " type would allow, a simpler form of conversion without refinements or extensive modifications was adopted. Their four single 4·7in guns and four of their eight 21in torpedo tubes amidships were suppressed, and a new armament was mounted without seriously altering the normal destroyer silhouette or changing the shape of the hull above the main deck. They now carry two 4in guns in a twin mounting before the bridge, two squid anti-submarine weapons and four 21in torpedo tubes just before the diminutive pole mainmast, and seven 40mm Bofors A.A. weapons distributed amidships and one on the quarter-deck. As in the full conversion there is no weapon on the forecastle.

Fig. 7—H.M.S. " Orwell," First Medium-Size Fast Anti-Submarine Frigate

The remaining four destroyers completed or taken in hand for the simpler form of conversion as fast anti-submarine frigates are the " Opportune," " Orwell " (Fig. 7) " Paladin " and " Petard," somewhat smaller vessels with a standard displacement of 1540 tons and full-load displacements of 2315 to 2430 tons, an overall length of 345ft, a beam of 35ft, and a draught of 15ft 8in. These ships originally had an armament of four old pattern 4in guns, twelve small A.A. pieces, and eight 21in torpedo tubes. Their propelling machinery comprises two Admiralty three-drum type boilers supplying steam to a two-shaft arrangement of Parsons geared turbines developing 40,000 s.h.p., equal to speeds of 34 to 36 knots. These handy vessels are more nearly of the normal frigate size, though nearly twice as fast.

Another reconstruction project started in 1953, though in this case largely experimental, was the conversion of H.M.S. " Grey Goose " from a steam gunboat into a gas turbine fast patrol boat by the installation in her of two Rolls-Royce prototype " R.M. 60 " gas turbine engines of a design similar to that of aircraft propulsion units. The " Grey Goose," constructed of steel, was built by J. Samuel White and Co., Ltd., Cowes. When first completed in July, 1942, she had a standard displacement of 205 tons, increased to 260 tons at full load, with an overall length of 145ft 6in, a length between perpendiculars of 137ft 9in, a beam of only 20ft and a shallow draught of 5ft 6in. She

Fig. 6—Fast Anti-Submarine Frigate " Termagant "

carried the exceptionally heavy armament of a 3in gun and ten smaller weapons and anti-aircraft pieces as well as depth charges and two 21in torpedo tubes. Two Metropolitan-Vickers single-reduction geared steam turbines of high efficiency, developing an aggregate of 8000 s.h.p. and fed from a single boiler, gave her a speed of over 35 knots. Her two new Rolls-Royce gas turbines will develop a total of 12,000 h.p. She is being converted by Vosper, Ltd., Portsmouth. The "Grey Goose" is the sole survivor in the Royal Navy of a class of seven coastal-forces craft built during the war, on the pattern of miniature destroyers with powerful steel hulls, to serve as E-boat killers.

## Australia

Late in 1953 the Australian Minister for the Navy announced that the completion of H.M.A.S. "Melbourne" (ex-H.M.S. "Majestic"), the second aircraft carrier intended for the Royal Australian Navy, would be delayed for about six months by the fitting of the angled deck. This ship, a light fleet aircraft carrier, is being built in Great Britain by Vickers-Armstrongs, Ltd., Barrow-in-Furness. The "Majestic" was laid down on April 15, 1943, and launched on February 28, 1945, but ever since she was transferred in an incomplete state to the Australian Government there has been a series of constructional delays due to modifications in the design, mainly concerned with the installation of an improved steam catapult apparatus, to allow her to operate jet aircraft, and with the incorporation of the angled flight deck at 6 deg. off the centre line; she will not be ready for commissioning until the middle of 1955. She was originally intended to be an identical sister ship of Australia's first aircraft carrier, H.M.A.S. "Sydney" (ex-H.M.S. "Terrible"), with a standard displacement of 14,000 tons and a full-load displacement of 19,550 tons, but according to the 1953–54 Navy Estimates her dimensions have been revised and she will now have an overall length of 702ft with a length between perpendiculars of 630ft and a water line beam of 80ft. She will be armed with thirty-two guns; four Admiralty three-drum boilers and Parsons single reduction geared turbines of 42,000 s.h.p. will give her a speed of 25 knots.

Of the four very large destroyers being built in Australia, the "Voyager" had by the end of 1953 reached an advanced stage of construction, having been laid down at the Cockatoo Island Dockyard, Sydney, on October 10, 1949, and launched on March 1, 1952, when a sister ship, the "Vendetta," was begun in the same yard. The other two vessels of this type are under construction at H.M.A. Naval Dockyard, Williamstown, the "Vampire" having been started on July 4, 1949, while the "Waterhen" commenced assembly in December, 1952. These vessels, the largest destroyers ever built in the Commonwealth, are of a design basically similar to that of the "Daring" class ships recently built in Great Britain for the Royal Navy, but modified to suit Australian conditions.

Six new fast anti-submarine frigates of the most modern design are also being built in Australian yards, three by the Cockatoo Island Dockyard, Sydney, and three at the Williamstown Naval Dockyard, Melbourne. It is officially stated that, although they are to be known as anti-submarine frigates, they will actually be more like destroyers, in which the capacity for anti-submarine operations will be the principal factor in determining the provision of weapons and equipment. Of approximately 2000 tons displacement with a speed of about 30 knots, they will be armed with several small-calibre guns and anti-submarine weapons of improved squid design.

H.M.A.S. "Quadrant," described as Australia's first fast submarine killer and "the first R.A.N. atom age ship," was completed on July 16, 1953, when a brief commissioning ceremony was held at Williamstown Naval Dockyard, where her reconstruction had taken nearly three years. This vessel, one of five destroyers presented to Australia by the British Government in 1950, was converted into a fast anti-submarine escort frigate, and it is claimed that the vessel is in the class of H.M.S. "Rocket" and "Relentless," the most modern and scientifically equipped submarine destroyers of the Royal Navy. The superstructure is entirely different from that of the conventional ship, it is stated. The old familiar type of bridge has gone, the vessel now being controlled from an operations room much less conspicuous. Aerials, radar instruments and all kinds of specialised apparatus for detecting submarines and steering the ship at high speed to attack them, are installed above and below the decks. The attacking equipment includes a mortar-like weapon with three barrels to fire projectiles 5ft long with fins to ensure accurate flight and automatically set to explode at predetermined depths around a submarine. Three other gift destroyers, namely, the "Queenborough," "Quiberon" and "Quickmatch," are also being converted to fast anti-submarine escort frigates in Australian dockyards at Cockatoo Island and Williamstown, but at the time of writing there is no news of the taking in hand of the fifth unit of this class, the "Quality." All these ships, as destroyers, originally had a standard displacement of 1705 tons, increased to 2425 tons at full load with two Admiralty three-drum boilers and a two-shaft arrangement of Parsons geared turbines of 40,000 s.h.p., designed for a maximum speed of 36¾ knots.

**Fig. 8—Fully Converted Fast Anti-Submarine Escort H.M.C.S. "Algonquin"**

## Canada

Work was started in 1953 on the completion of the suspended light fleet aircraft carrier "Bonaventure" (ex-"Powerful"), which was purchased by Canada from Great Britain in an incomplete state for reconstruction and modernisation. This ship was laid down on November 27, 1943, and launched on February 27, 1945, at the Belfast yard of Harland and Wolff, Ltd., but her construction was stopped in May, 1946, and she was laid up and abandoned for over six years in her unfinished condition. Before the resumption of work on the ship she was redesigned to handle jet aircraft, the modifications including the strengthening of the flight deck and elevators, improvements in deck arrester gear, and the installation of the new British steam catapult which is capable of launching heavy aircraft. Plans were again revised recently to provide for a completely modern aircraft carrier embodying the angled deck arrangement. The "Bonaventure" will therefore not be ready for service for some time, and she may turn out heavier than the 14,000 tons standard displacement, increased to 19,550 tons, originally estimated and longer than the 695ft first projected. The construction has been resumed by her original builders.

The first of Canada's fourteen new construction anti-submarine escorts, the "St. Laurent," laid down on November 22, 1950, and launched on November 30, 1951, was structurally complete by the end of 1953. This vessel, officially rated as a destroyer escort, was built by Canadian Vickers, Ltd., Montreal, which is also building a sister ship, the "Ottawa," begun on June 8, 1951. Halifax Shipyards, Ltd., has under construction two more of these ships, the "Saguenay," started on April 4, 1951, and the "Margaree," laid down on September 24, 1951. Another pair of "DEs," the "Skeena" and "Fraser," begun on June 1, 1951, and December 11, 1951, respectively, are the responsibility of the Burrard Dry Dock and Shipbuilding Company, Ltd., North Vancouver. The keel of the seventh vessel of the first batch, the "Assiniboine," was laid by Marine Industries, Ltd., Sorel, Quebec, in May, 1952. The later group of seven A/S escorts are being built one by each of the four firms mentioned above and one each by Davie Shipbuilding and Repairing Company, Ltd., Lauzon, P.Q., Victoria Machinery Depot Company, Ltd., B.C., and Yarrows, Ltd., Victoria.

The "St. Laurent" has a displacement of 2000 tons and is armed with four rapid-firing 3in anti-aircraft guns of U.S. pattern in twin mountings, two single 40mm Bofors A.A. pieces, and two ahead projecting triple-barrelled improved squid anti-submarine weapons. The propelling machinery comprises a two shaft arrangement of geared steam turbines designed for a speed of "over 20 knots," supplied by Yarrow and Co., Ltd., Scotstoun, Glasgow, and installed by Canadian Vickers, Ltd., Montreal. The main turbines and condensers are of English Electric design. The remaining thirteen ships will have similar propelling machinery of British design, but manufactured in Canada. They are officially classed as major warships and as such are the first to be designed completely in Canada. These anti-submarine escort vessels or frigates of a high-speed class are intended primarily for the detection and destruction of modern fast submarines, and in evolving their design much assistance was received from the Royal Navy and the United States Navy. In function the vessels will supersede the frigates and corvettes of the second world war, and, like the corvettes, their design was worked out so that in the event of emergency they could be produced rapidly and in quantity. In speed, manœuvrability and weapons, the ships will fulfil all the requirements of their

class for modern sea warfare. The design provided for flush deck, low bridge, compartmented hull, and considerable use of aluminium instead of steel for the superstructure, fittings and furniture.

But a much faster and more formidable submarine killer materialised in 1953 in the shape of H.M.C.S. "Algonquin" (Fig. 8), which was completed for trials, commissioned in service and actually proved her worth at sea. This former fleet destroyer has undergone full conversion similar to, but by no means identical with, that of the fast anti-submarine frigates "Relentless" and "Rocket" in the Royal Navy, although she is actually known as an anti-submarine destroyer with the typical American designation of DDE and in fact is more heavily armed as far as guns alone are concerned. Among the many points of difference as compared with the British "R" class are a forward control superstructure one deck higher, surmounted by an open conning bay or compass platform, extending from the heavy lattice foremast to the enclosed bridge front, which is three sided and raked and pierced by watertight doors to give access to the forecastle, instead of vertical and rounded and unpierced; a taller level-capped funnel reminiscent of that in the "Algerine" class ocean escort minesweepers (FSEs); the sturdy lattice mainmast stepped considerably further aft; and two 3in guns in a twin mounting of United States pattern on the forecastle in sharp contrast to the British full conversion, which has no guns in "A" position. The "Algonquin," originally completed by John Brown and Co., Ltd., Clydebank, in 1944, had a standard displacement of 1710 tons, increased to 2530 tons at full load, and her propelling machinery comprised two Admiralty type three-drum boilers and Parsons geared turbines turning two shafts and developing 40,000 s.h.p., equal to a speed of 34 knots. Her sister ship, the "Sioux," built at the same time by J. Samuel White and Co., Ltd., Cowes, and two slightly later destroyers, the "Crescent" and "Crusader," completed at Clydebank in 1945, are also being converted similarly.

*(To be continued)*

# Coal in 1953

By SIR RICHARD REDMAYNE, K.C.B., M.I.C.E., F.G.S.

No. I

## Results for the Year 1952

THE full results of the operation of the coal mining industry of this country for any year are not available until early in the succeeding year. For the quarterly statistics issued by the National Coal Board, with the exception of those for the three first quarters are not made public until too late for reference and comment in the year to which they relate.

The main points gathered from the complete statistics for 1952 are as follows :—

| | Year 1952 £ |
|---|---|
| Colliery profits | 5,725,111 |
| Loss on open-cast working | 993,050 |
| Profit of ancillaries | 3,842,671 |
| Profit | 8,574,732 |
| Interest payable, less interest receivable and other income | 319,373 |
| Loss on imported coal | 1,193,553 |
| Profit | 7,061,806 |

After deduction of the interest payable to the Ministry of Fuel and Power, compensation for loss of office, workmen's compensation, &c., the year's working resulted in a deficit of £8,188,194, compared with a deficit of £1,600,000 in 1951. The accumulated deficit since vesting date at the end of 1952 was £14,000,000. It will be seen that the operating profit on the collieries amounted—in round figures to only £5,700,000 as against £21,200,000 in the previous year; but the profit on coke ovens increased by £1,600,000, and the loss on imported coal fell from £5,500,000 to £1,200,000. The increased cost of production, which amounted to 7s. 6d. per ton, was not covered by the advance in selling price, for proceeds rose only by 6s. 11d. per ton. Higher wages and lower productivity with increased prices of stores and materials accounted for the higher cost of production. The output of saleable coal from the N.C.B. mines amounted to 212,215,721 tons; of this 9,776,491 tons were consumed at the mines and 5,745,501 tons went as miner's coal. Production was more seriously affected by disputes than in any year since 1947. According to figures issued by the Ministry of Fuel and Power in January, 1953, the stoppages in the first eleven months, excluding those involving less than ten workers or less than one day, were no fewer than 1139, or about two-thirds of the country's strikes, and this in a nationalised industry! The coal lost by these disputes amounted to about 1,378,600 tons, compared with 802,600 tons from like cause in 1951.

Wages costs, already much increased by the advance accorded at the end of 1951, grew in proportion with the growth of the labour force in the industry, for on December 29, 1952, this force comprised 719,700 workers as against 697,400 on December 22, 1951. Many of the fresh entrants, being new to the job of mining, would not make a full contribution to output. But too much may be made of this argument, for the largest increase of manpower took place in the first quarter of 1952 when there was the largest intake of workers and output continued to rise.

The output per man shift during the greater part of 1952 averaged 1·19 tons, compared with 1·21 tons in 1951. In addition to the output from the N.C.B. mines recorded above, a preliminary estimate showed there was to be added thereto 12,108,500 tons obtained from the open-cast workings. But the total output of coal from these two sources was only about 3,000,000 tons above that of 1951. During 1952 318,000 tons of coal were imported, compared with 1,229,000 tons in 1951 and up to December, 1952, 11,524,000 tons were exported compared with 7,816,000 tons in the corresponding period of the year before. Inland consumption was lower than in 1951.

The following table serves to illustrate the National Coal Board's progress from the year 1949 to 1952, inclusive.

TABLE I—*N.C.B. Progress from* 1949 *to* 1952

| | 1949 | 1950 | 1951 | 1952 |
|---|---|---|---|---|
| Output (million tons) : | | | | |
| Deep-mined | 202·7 | 204·1 | 211·9 | 214·3 |
| Open-cast | 12·4 | 12·2 | 11·0 | 12·2 |
| Man-power (thousands)(yearly average) | 720 | 697 | 699 | 716 |
| Attendance (shifts a year of fifty-two weeks) | 243 | 245 | 250 | 249 |
| Productivity (tons a man-shift) | 1·16 | 1·19 | 1·21 | 1·19 |
| Earnings (a man-shift) : | s. d. | s. d. | s. d. | s. d. |
| Face workers | 43 1 | 44 10 | 48 6 | 54 0 |
| All workers | 34 4 | 35 6 | 38 10 | 43 2 |
| Colliery profit (a ton) | 2 11 | 2 5 | 2 0 | 0 6 |

As already stated, one is limited to the first three quarters of 1953 when reviewing the results of the year's working of the mines operated by the N.C.B.

During the first three quarters the revenue results were as shown in Table II.

During the first three quarters of the year there was a loss of £1,073,789, and there seems little prospect, therefore, of there being any reduction of the accumulated deficit in 1953.

## Production

The output from the collieries worked by the N.C.B. for the first two quarters of the past year amounted to 106,768,201 tons as against 107,570,907 tons over the same period in 1952.

TABLE II—*N.C.B. Revenue for First Three Quarters of* 1953

| | First quarter | Second quarter | Third quarter |
|---|---|---|---|
| | £ | £ | £ |
| Colliery profits | 5,523,133 | 6,308,187 | 156,891 |
| Estimated profit or loss on open cast working | −12,000 | +430,000 | +500,000 |
| Estimated profit of ancillaries | 740,000 | 300,000 | 350,000 |
| | 6,251,133 | 7,038,187 | 1,006,891 |
| Interest payable less interest receivable and other income | 160,000 | 180,000 | 180,000 |
| Provision for taxation | 1,500,000 | 2,000,000 | 600,000* |
| Estimated profit for the quarter | 4,591,133 | 4,858,187 | 1,726,891 |
| *Less* estimated interest payable to the Minister of Fuel and Power | 4,050,000 | 4,050,000 | 4,150,000 |
| Estimated surplus for the quarter | 541,133 | 808,187 | −2,423,109 |

* This figure represents loss on imported coal.

The figures in respect of the first three quarters of the past year are as follows :—

| | First quarter, tons | Second quarter, tons | Third quarter, tons |
|---|---|---|---|
| Tonnage disposable commercially | 50,957,172 | 48,281,612 | 44,093,564 |
| Mine consumption | 2,502,351 | 2,319,769 | 2,131,374 |
| Miners' coal | 1,459,654 | 1,248,368 | 1,052,001 |
| Saleable tonnage from N.C.B. mines | 54,919,177 | 51,849,749 | 47,278,139 |

The only correct way of determining the output per man employed is to arrive at the actual average output per man per shift, per annum. The effect of declining productivity in raising costs is shown by the fact that though wages level rose by slightly less than 10 per cent between 1951 and the third quarter of 1952, the labour cost per ton of coal sold rose by more than 15 per cent.

There is little prospect at the time of writing of much increase in the output for 1953 over that of 1952, for up to the end of the third week in November the total of deep-mined coal for the year so far reached 187,111,500 tons or 1,807,500 tons less than the output for the same period in 1952. Doubtless the fall has

been due to the additional week's holiday, which, according to the Coal Board, resulted in a reduction of 5,500,000 tons in output, despite the fact that on the average there have been 720,000 workers at the mines, as against 714,000 in 1952. But Mr. Geoffrey Lloyd, speaking in the House of Commons on October 26th, mentioned that with two months yet to go, there had been achieved a recovery of 3,508,000 tons, and he hoped that, seeing the last two months of the year are normally the best from the point of view of production, the gap of 2,000,000 could be closed.

Absenteeism has been greater during the past year than in 1952 ; and, in spite of the advancement in mechanisation and equipment generally, the average output per man-shift has been only a trifle higher than in 1952. Unless the results of the third and fourth quarter show that there has been an average of 124,000 tons more per week—equal to an advance of about 3 per cent—the total for the year will not reach that of 1952.

The outlook in respect of output was sufficiently serious for Mr. Geoffrey Lloyd (Minister of Fuel and Power) to state in the House of Commons on July 13th that the Government had authorised the N.C.B. to import large coal from Western Europe, where there is now a surplus, so as to avoid a serious coal shortage. He added that they would not cut coal exports. He was consulting the N.C.B. about briquetting plants, which were being worked at about only half capacity.

Major S. Walton-Brown pointed out, in his presidential address to the Annual Conference of the British Association of Colliery Managers at Blackpool on May 8th last, that " in studying the individual production per man-year one was bound to admit that something must be seriously wrong. For substantial progress should have been made in seven years." With a view to improvement he suggested that the best procedure might be a series of experiments. As one of these he would free one area general-manager in each division entirely from divisional control, and allow the divisional board in his case merely to act as a post office, with the area general-manager free to manage his own affairs within such national limitations as were applicable to his division. Much was to be said for making areas authoritative and, if greatly improved results were obtained, there would be greatly improved rewards. Above all, the area general manager should be free to appoint, pay, and control his non-industrial staff.

There is much to be said in favour of this proposal from one who himself proved, in pre-nationalisation days, an able and experienced colliery manager.

### Cost of Production

The high cost of production characterising the year 1951 was higher still in 1952, and increased further during 1953 as the following figures show :—

| | Total cost per ton s. d. |
|---|---|
| Year 1952... ... ... ... ... ... ... ... ... ... | 56 8·5 |
| First quarter, 1953 ... ... ... ... ... ... ... ... | 57 3·4 |
| Second quarter, 1953 ... ... ... ... ... ... ... ... | 59 2·7 |
| Third quarter, 1953 ... ... ... ... ... ... ... ... | 61 1·9 |

Higher wages, lower productivity and increases in the prices of stores and materials were the main reasons for the increases in costs during 1952, according to the annual report of the N.C.B. issued in May, 1953. It cost 56s. 8·5d. to produce a ton of coal in 1952 as against 49s. 2d. in 1951. In its effort to restrict costs the Board places much reliance on the reconstruction of old mines and the opening out of new ones, both matters which take a long time to effect. In the meantime the demand for coal prevents the closing down of uneconomic pits, of which it is estimated there are some 300 out of a total of 950. In connection with the subject of renovation of the mines, it will be remembered that in 1950 the Board planned for a production of 240 million tons per annum to be reached by the period 1961–65.

Addressing the Summer School at Oxford on September 7th last, Mr. E. F. Schumacher, economic adviser to the N.C.B., said that just one-half of the coal mined by the Board in 1952 was produced at an operating loss ; about 35,000,000 tons, one-sixth of the total output, was produced at 283 pits at a loss of 10s. a ton or more. On the other hand, 340 pits were producing 51 per cent of the output at a profit ranging from a penny to more than £1 a ton. These were the pits to which the Board was looking for additional production.

Mr. Schumacher pointed to the comparatively small part that salaries played in the cost per ton, instancing the fact that salaries of £750 a year or more in the industry cost less than 8½d. a ton of coal produced out of 56s. 9d. of that cost in 1952. If coal was expensive, he said, it was not because of the 8½d., but because of the 56s.

### Profit per Ton—Prices and Export

The profits or losses per ton, before charging interest, earned during the year 1952, and the first three quarters of 1953, and average proceeds per ton, as stated in the annual and the quarterly statistical returns of the N.C.B., were as follows :—

| | Average proceeds per ton | Profit per ton |
|---|---|---|
| | s. d. | s. d. |
| For the year 1952 ... ... ... ... ... | 57 3·0 | 0 6·5 |
| For the first quarter of 1953 ... ... ... | 59 3·5 | 2 0·1 |
| For the second quarter of 1953 ... ... | 61 7·9 | 2 5·2 |
| For the third quarter of 1953 ... ... | 61 2·7 | 0 0·8 |

It will be seen that the increase in profit shown in respect of the first two quarters of 1953 over that for the year 1952 has only been obtained by the enhancement of the selling price of the coal.

On January 9, 1953, Sir Hubert Houldsworth, the National Coal Board's chairman, told the miners' union officials, who met in London, that an increase of from 5s. to 6s. 6d. a ton on the price of coal would be essential unless costs were brought down by greater productive effort.

As from March 2nd last the price of coal was raised by 10 per cent, or an average increase of 5s. 6d. per ton (which is the biggest advance since nationalisation in 1947). In consequence, the Iron and Steel Corporation asked for an increase in iron and steel prices to cover the extra cost which would fall on the industry, it being estimated that this increase in cost in respect of steel would amount to nearly 11s. a ton. It was estimated, too, that another £10,000,000 a year would be added to the generating bill of the British Electricity Authority (though about £5,250,000 would be recovered from industrial owners whose tariffs are tied to fuel costs). The gas industry and railways were also considerably affected. In regard to the former, the increase in cost would amount, it was estimated, to £8,000,000 a year ; and as to the railways, the dearer price of the coal they consume would add nearly £4,000,000 a year to their running costs. And so the vicious circle turns !

On Sunday, February 22nd, Sir Hubert Houldsworth, speaking in Cardiff, warned the miners that with the last increase in coal price the limit had been reached which the public will be willing to pay, that any increase on the top of the 5s. 6d. a ton, announced the day before, " will," he said, " meet with resistance from the consumers." Speaking at the meeting, Sir William Lawther, the President of the Miners' Union, alluding to the necessity of a greater effort to increase production of coal at the pits, said, " If we fail in the effort now, nationalisation will be a failure."

On March 11th, a motion supported by more than 100 Conservative M.P.s was tabled in the House of Commons expressing concern at this latest increase in the price of coal, calling for an inquiry into the structure and administration of the National Coal Board and urging on the Government the need of a National Fuel Policy.

" With regard to the possibility of expansion in our export of coal, the position is worsened by the increased cost of production," as *The Times*, in a wise leading article, entitled " The Limit for Coal "—in its issue of March 23rd — pointed out : it stated that though British coal was still the cheapest in Europe, Continental coal prices were difficult to assess. During a shortage the inducement was, if anything, to inflate costs on paper rather than reduce prices in practice. German costs in particular were almost certainly lower than they looked, and it was a safe generalisation that lower prices would be found easy enough to quote once a shortage disappeared. The Coal Board therefore needed to plan on the assumption that it would shortly have to face competitive conditions.

The modest increase of 3,250,000 tons in export, including bunkers, obtained in the year 1952 may or may not be repeated in 1953. Statistics to date are not complete, but there can be little doubt that in so far as the export of coal from Britain to the Continent of Europe is concerned, the possibility of a continuance for long of the high prices we have of late obtained is very doubtful. Indeed, Sir Hubert Houldsworth, at his meeting with the miners just referred to, went so far as to state that the industry was in danger of losing its traditional export markets.

The annual report for 1952 of the Liverpool Steamship Owners' Association was severely critical of the coal industry for its " conspicuous failure " to pull its weight in the export trade, pointing out that seven years after the first world war we exported 54,000,000 tons of coal, but that seven years after the second world war we exported only 14,000,000 tons.

In 1952 we paid £335 million for imported oil, whereas our exported coal brought in only £66,000,000—a startling fact !

### Consumption and Stocks

A steady increase in inland consumption of coal may be expected year by year. It will be remembered that the Ridley Report, published in September, 1952, put the consumption tentatively at 20,000,000 tons more per year ten years hence, and the Federation of British Industries put it a great deal higher than that. Consumption has certainly been heavier in 1953 than in the preceding year. It was up by 2,500,000 tons by September, over half of the extra being devoted to electrical generating stations, and a further 600,000 tons to coke ovens—reflecting the increased output of pig iron—most of the remainder having gone to other industries. It would appear likely, therefore, that the final total consumption for 1953 will prove to be in excess of that of 1952.

The outlook in respect of stocks of coal, which had been precarious early in the year later on improved considerably, and Mr. Geoffrey Lloyd was enabled to make a reassuring statement in the House of Commons on October 26th. He said that on the seventeenth of that month they had 18,400,000 tons of coal in stock, adding that "with stocks rising at between 300,000 and 350,000 tons a week, we have a good prospect of arriving at just under or just over 19,000,000 tons by the beginning of the coal winter." The coke situation was such that he was able to increase the domestic ration from 30 cwt to 2 tons.

According to the chairman of the Gas Council, Sir Harold Smith, speaking at a Press Conference in London on October 27th, the gas industries coal bill to-day was £25,000,000 a year more than at the prices ruling at vesting day. He stated, too, that supplies of good gas-making coals were steadily decreasing and becoming harder to get.

### Man-Power : Miners' Earnings : Absenteeism

Complete statistics for the year 1953 are not yet available as to the number of workers employed at the collieries, but it appears likely from such figures as have already been made public that the average figure for a staff of 716,000 of 1952 will have been maintained if not exceeded. For at the beginning of September the number totalled 714,500 compared with 718,400 in July. But there were more face workers in September than at the same time in the previous year, 299,600 as compared with 296,000. The average earnings per man per shift were, for the year 1952 and the first three quarters of 1953 (inclusive of allowances), were as follows :—

| | At the face | All workers underground | Surface | All workers |
|---|---|---|---|---|
| | s. d. | s. d. | s. d. | s. d. |
| Year 1952 ... ... | 53 11·7 | 46 11·2 | 31 4·4 | 43 2·4 |
| First quarter, year 1953 | 56 1·8 | 48 7·0 | 32 7·8 | 44 10·7 |
| Second quarter, year 1953 | 56 7·1 | 49 1·4 | 33 5·3 | 45 5·1 |
| Third quarter, year 1953 | 56 7·2 | 48 10·8 | 33 0·5 | 45 2·1 |

The object of the miners' leaders has been that under nationalisation there should be a uniform national wage structure. Owing, however, to the great variations in the geological and physical conditions, and in view of the differences in methods of employment and payment, of very long standing, obtaining in the respective coal-fields, this will not be easy of achievement.

In spite of the fact that the average earnings a shift were, for 1952, 12 per cent in advance of 1951, a larger increase than any since nationalisation took place, yet towards the close of that year the miners' leaders put forward a claim for an additional advance in the wages of the 400,000 datal workers, no amount being specified. The Board's offer of 6s. a week increase to the 100,000 men on the minimum basic rate, on condition that most piece rates were stabilised for a further period, and Saturday working was continued during the next coal year period (i.e. from April 30, 1953)—which was in the nature of an interim offer whilst both parties were working on a new wage structure, was rejected by the miners, and their executive was instructed to continue negotiations with the Board for new national rates for the day-wage men.

The Board's further offer of an increase of 4s. a week to nearly 400,000 day-wage men, and to pay the 150,000 day-wage men who were receiving only the minimum rate, 6s. a week (the minimum rate for underground workers being then £7 0s. 6d., and for surface workers £6 1s. 6d.) was not accepted. On January 27, 1953, the miners' delegates' meeting in London decided that their executive should renew its efforts to obtain the increase of 6s. a week for the 400,000 day-wage men, but inform the Board that it would recommend the continuance of the Saturday shift for another year.

On February 12th the dispute was settled by the Board acceding to the miners' demand by granting to some 320,000 day-wage men the extra 6s. a week claim, the concession becoming effective as from February 16th. It was estimated that this increase would add £6,000,000 a year to the wages bill and would be equivalent to a cost per ton of 6d. The miners' leaders agreed to recommend the continuance for a year of the Saturday shift. It has been estimated that the working on Saturdays results in an addition of 12,000,000 tons of coal to the year's output. In May last there were rumours that the miners would probably put forward a further claim in July. The last advance together with other higher costs necessitated an advance in coal price of up to 5s. per ton early in the year in order to permit the Board to break even.

On July 7th, at a meeting in Hastings, the miners' leaders won their point on wages policy, a motion demanding a substantial increase in wages being withdrawn at their suggestion ; but another motion calling for a higher wage for the lower paid grades was remitted to the executive without a vote. The executive, however, before taking any action on the claim was going to examine the levels of production, costs, efficiency and selling prices in the coal industry. The present minimum rates are £7 6s. 6d. for underground workers and £6 7s. 6d. for surface workers.

On September 26th the miners' leaders had an informal preliminary meeting with the chairman of the Board on the subject of the latest wages claim in respect of the day-wage men which it was understood was for 2s. 3d. increase per shift in respect of all day-wage men working underground and 2s. 1d. increase per shift for all surface day-wage workers, so as to bring the minimum rates to £8 a week underground and £7 a week surface. If granted, this would cost the N.C.B. more than £12,000,000 a year to meet.

On October 13th the miners formally presented their claim to the Board, which took the form of increases of 13s. 6d. and 12s. 6d. a week, respectively, on behalf of from 350,000 to 400,000 workers, which, if granted, it was estimated would cost £14,000,000 a year and add about 1s. 6d. to the selling price of coal. The Board declined to accede to the claim and the miners' representatives decided to report the decision to a meeting of the miners on October 29th.

Absenteeism has continued to be very high. Strenuous efforts are to be made towards securing a better attendance at work. This was foreshadowed at a Press Conference at Barnsley on March 22nd last, after a meeting of some 2000 miners and management representatives—the seventh such meeting of the "campaign" instituted by the N.C.B. and the Miners' Union. In this particular division in Yorkshire the attendance losses had been between 20 and 22 per cent during February and March. On July 5th Sir Hubert Houldsworth, speaking at Hastings, gave a sharp warning to the National Union of Mine Workers over growing absenteeism in the coal-fields, which he described as "an exceedingly disturbing development. Compared with 1952 we are losing two shifts per man, which represents the loss of 1,700,000 tons of coal" ... "If this diminution in the shifts worked continues in the second half of this year, we shall lose, as compared with 1952, nearly a week's output from increased non-attendance. We cannot stand this."

For the first four months of 1953 overall absenteeism averaged 13·07 per cent, compared with 11·81 per cent over a like period in 1952. As will be remembered at the end of 1952 a concession was made to miners that the bonus of an extra shift's earnings paid to those who work five shifts a week should also be paid to those working less than five shifts a week, but who produce a doctor's certificate justifying their absence owing to ill-health. "Voluntary absenteeism" has fallen, but "Involuntary absenteeism" has increased by almost one-third, in the early months of 1953, which forces one to the conclusion that this concession has been grossly abused. As *The Times* put it, "absenteeism is merely a symptom. The weakness lies in the organisation and those who are working it. Lack of discipline is one aspect of the lack of understanding between miners and management."

### The National Coal Board

For some time past there has been criticism both in Parliament and in the Press of the working and efficiency of the National Coal Board, wrongly so in the opinion of the present writer. The faults, if faults there are—and it would seem incontestable that inefficiency has characterised the industry for some years past—should not be attributed to the Board *per se*, but to the system created by nationalisation. As Colonel Lancaster said in the House of Commons in the debate of October 20th : "For something like two years now it has become evident that the advantages of nationalisation have been outweighed by its inherent disadvantages . . . the scheme was put together too hurriedly."

Early in 1953 a large number of Conservative Members urged in Parliament that an inquiry should be held into the operations of the N.C.B. and that a National fuel policy should be introduced. As *The Times* stated in its leading article in its issue of April 23rd : "there is little doubt that during the past few years the Board and the Divisions have got out of touch with the pits and the miners."

And again in its issue of May 14th, it stated "that all is not well with the coal industry none will deny. The Minister was right, however, to reject the proposal for an inquiry. It would only have deflected the Board's energies from the vital task . . . the coal industry has been nationalised for over six years and none of the great hopes which it was said to hold out for the nation as a whole has so far been fulfilled. Unless there is early progress changes will have to be made."

In the management of the coal mining industry in particular, decisions have to be made at the colliery in the light of immediate circumstances. Occasions arise when immediate action is vitally necessary, and will not brook of the delay resulting from reference to a central authority far distant from the scene for its consideration and assent. The fault appears to lie in the statutory structure of the Board.

In the House of Commons, on October 26th, the Minister of Fuel and Power announced that the National Coal Board is to investigate its own working organisation to achieve greater efficiency and higher

production. That arrangement in the writer's view will be much more satisfactory than an inquiry from outside, for it will be one carried out by experts in the industry—managerial, selling and labour.

The investigation by the N.C.B., comprising within its orbit fifty or more areas in which the mines are grouped, if thorough, as we believe it will be, will entail much work and much time to accomplish. It will also, it is hoped, embrace the structure of the Board itself. It is to seek advice also from leaders of outside industrial concerns and from trade unions.

The present writer is in emphatic agreement with the words of *The Times*' leading article of October 27th : " That change of organisation will be good if, and only if, it shifts power to the qualified people at all stages of command, not away from them."

Mr. Geoffrey Lloyd also announced during the year the formation of a non-profit-making company—" The National Industrial Fuel Efficiency Service "—to help industry and non-industrial firms on the economical use of all forms of heat, fuel and power. This company will receive no direct Government subsidy but be financed by contributions from the N.C.B., the British Electricity Authority and the Gas Council. The chairman of the company is Sir Leslie Hollinghurst.

INVESTMENT—MODERNISATION OF OLD COLLIERIES AND OPENING OUT OF NEW ONES

According to the Board's last annual report, investment in " Reconstruction and Development " in the year 1952 cost £38,000,000, which was only 64 per cent of the planned investment ; and the signs are that the expenditure envisaged in the initial plan will, if anything, prove to have been underestimated. It is, therefore, states the report, a matter of serious concern that investment should be so much less than planned. The new schemes ought to have been making a greater contribution to production. It will be remembered that " The Plan for Coal," drawn up in 1949, envisaged an investment in collieries to average £38,000,000 over the years 1951–58. Since 1949 prices have so increased that the Minister of Fuel and Power, on October 17th, put the figure at £53,000,000. During the year 1953, he stated that the rate of investment was increased by £10,000,000, bringing it up to—in round figures—£48,000,000, and in 1954 it could, he said, certainly be further increased to £58,000,000.

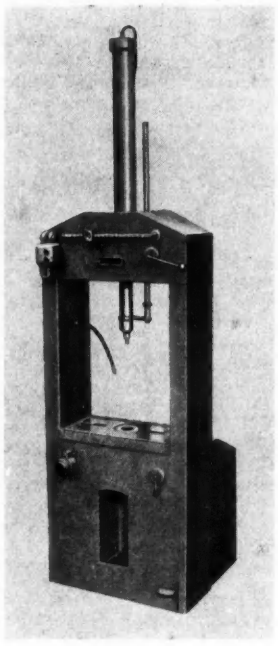
*(To be continued)*

## Hydraulic Power Press

A HYDRAULIC power press is now being made in three models with working pressures of 9, 20 and 50 tons, by W. H. Marley and Co., Ltd., 105, High Road, London, N.11. These presses, one of which is illustrated here, are of all-welded plate construction with a rigid integral table of heavy plate which is 24in wide by 12in deep. Each press has a long stroke, double-acting, hydraulic cylinder locked into the top beam. Pressure fluid is supplied to this cylinder from a motor-driven pump unit set in a tank formed by a rearwards extension of the base of the machine. In a 9-ton capacity machine the ram stroke is 18in long and in the two larger presses 24in long.

Movement of the press ram is controlled by a lever to be seen on the right-hand side of the top beam or by a pedal at the foot. These controls are directional and must be held in the operative position during working as, when they are released, the ram stops and remains stationary. Three ram speeds are provided in each direction and the required speed is selected by setting a small lever on one side below the table of the press.

Any required working pressure within the



**Hydraulic Power Press**

capacity of a machine can be pre-set by positioning a sliding block along a lever engraved with a scale, and placed in a convenient position on the front of the top beam. This sliding block acts as a weight on the lever which controls a pressure relieving mechanism in the hydraulic circuit. When the machine is used for short stroke operations an adjustable trip can be set to avoid loss of time by excessive movement.

As the machine is adaptable for push or pull broaching a suds tank is built into the base to provide cutting fluid. A range of special adaptors and fixtures is available with the presses which are stated to be readily adaptable for push and pull broaching, cropping, deep drawing, extrusion, piercing and other kinds of press work.

## Tests on Light Welded Radio Masts

FOR a number of years the British Callender's Construction Company, Ltd., has been supplying light welded radio masts which are made in 10ft sections for bolting together to form assemblies up to 120ft high. These masts are designed to withstand a wind velocity of 100 m.p.h. and a head load of 1000 lb at the maximum height. The firm states that numerous inquiries have been received as to the possibility of increasing the height of this design of mast, and recently some interesting tests were carried out as a result of an urgent inquiry from the Decca Navigator Company, Ltd., which wanted 150ft lightweight masts for use in connection with survey work in the Sahara Desert.

In view of the urgency of this inquiry, field trials were made on the masts at Taplow Court, Buckinghamshire, the headquarters of British Telecommunications Research, Ltd., where two 150ft masts were erected and subjected to torsion, wind loading and electrical tests.

The masts, which are triangular in cross section, are made up of standard sections, 10ft long, which have built-in climbing rungs, guy attachment plates and jointing studs. The leg members, which have centres 1ft apart, are made up of $1\frac{1}{16}$in outside diameter by 11 gauge Class " B " tubing braced by $\frac{1}{4}$in diameter mild steel rods. The masts weigh less than 7 lb a foot, and they are stayed at the 30ft level and thereafter at intervals of 20ft. Guy attachment plates are provided at the top end of each section to obviate any mistakes in assembly.

At the Taplow Court site the two masts were spaced 125ft apart and stayed at seven levels, and one of the two masts was erected on a dished baseplate, as shown in Fig. 1. This plate had an area of 240 square inches, and took the total down thrust of the mast and stays, amounting to approximately $4\frac{1}{2}$ tons. The other mast, which was later used by the Decca Navigator Company, Ltd., for electrical tests, had a post insulator, inserted between the bottom of each leg and the baseplate. The standard stay arrangement on this structure consisted of three stays to each stay level, and for the electrical tests glass rod insulators were inserted in all stays. The other

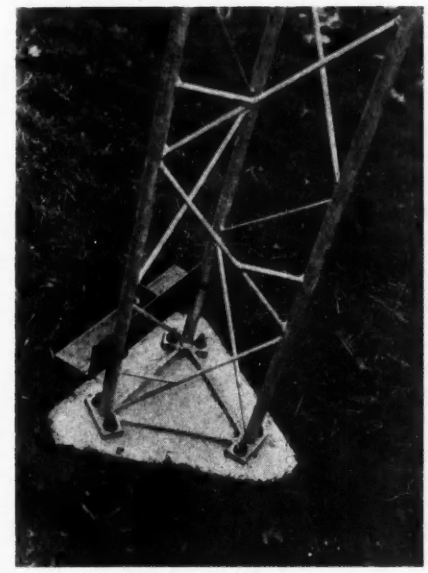


**Fig. 1—Mast with Dished Baseplate**

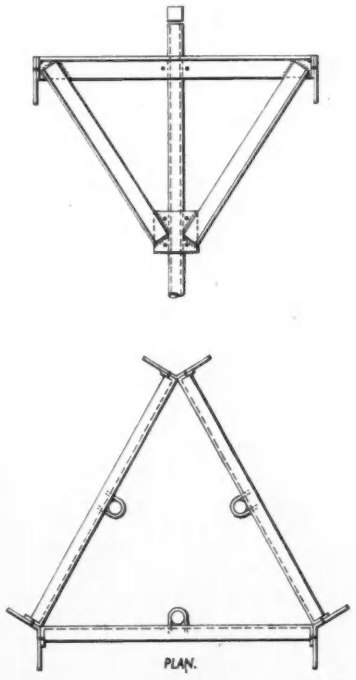



**Fig. 2—Frames Attached to Mast to Accommodate Twin Stays**

mast, which was subjected to torsional tests, was similarly stayed up to the 130ft level, but the head stays were varied in number and size for the three mechanical tests.

For the two torsion tests a horizontal member was bolted to the head of a mast, so that it projected approximately 3ft either side. A horizontal load was applied at right angles to one end of this cross arm, to apply a torque to the structure, and the deflection was measured against applied load. To restrict angular movement under torsional load two head stays were used in each of the three directions at the 150ft level with a small couple arm between them. The special frames used for this purpose are

shown in Fig. 2, and the results of this test are given in Table I.

TABLE I—*Torsion Test Twin Head Stays*

| Torque, lb-ft | Rotation deg. |
|---|---|
| 450 | 3 |
| 600 | 4 |
| 750 | 5 |
| 900 | 6 |
| 1050 | 6·8 |
| 1200 | 7 |
| 1500 | 7 |
| 1650 | 8 |
| 1800 | 8 |

The whole of the test was repeated with only single stays and its results are given in Table II.

TABLE II—*Torsion Test Single Head Stays*

| Torque, lb-ft | Rotation, deg. |
|---|---|
| 150 | 9 |
| 300 | 10 |
| 450 | 10·5 |

A test to reproduce the condition of wind force by a system of loading between the two masts was carried out by attaching ropes at various levels to one mast, taking them over pulleys at corresponding levels on the other mast and applying weights.

A load of 2000 lb was to be applied to the masts at the 150ft level, and measurements taken of the deflection at the mast heads, but owing to the premature failure of some of the ancillary test equipment only 1700 lb could be applied. The test showed, however, that the masts could easily take a 2000 lb head load without being crippled. With a head load of 1000 lb the deflection of the mast was 7·2in ; with a load of 1400 lb, 10in, and with a load of 1600 lb, 11·5in.

## Copying Lathe

DEMONSTRATIONS have been given in this country of recent designs of the " Sensitast " copying lathes made by the Heid Machine Company of Vienna, in order to show the classes of work for which they are suitable and some of the accessories which have been introduced to speed production and widen the range of application. These demonstrations were arranged by Newman Industries, Ltd., of Yate, Bristol, the British agents for the manufacturers.

One of the machines demonstrated and typical in many respects of the others, was the multi-purpose copying lathe illustrated on this page. This machine is made in two models with bed lengths of 3ft 3in and 4ft 11in, and it is designed to swing work up to 8⅝in over the cross slide and 14½in over the saddle.

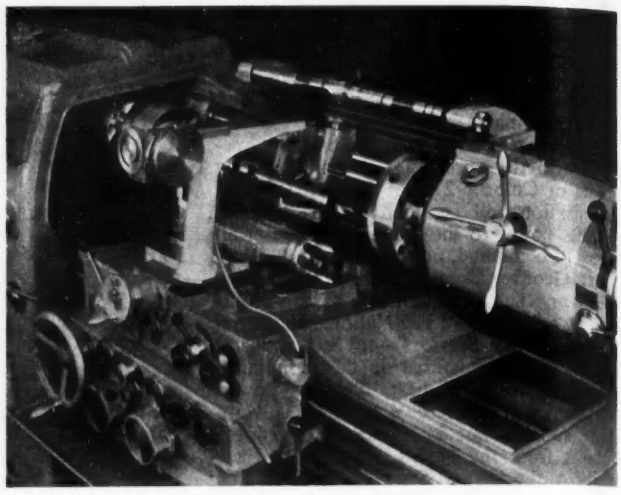
The rigid box-section bed of the lathe has a vee-groove guideway at the front and a flat way at the rear for the saddle, and a trough formed centrally between these ways is used to accommodate the leadscrew. A rack used for traversing the saddle is fitted at the side of the trough behind the front vee-way. Complete protection of the slideways, leadscrew and rack from swarf, dust and coolant is given by telescopic sheet metal guards. These guards are attached to the saddle on each side and move with it, so that they are effective in all working positions. A gap formed between the base of the headstock and the bed provides accommodation for the guards when the working position of the saddle is close to the spindle nose. Whilst the machine is running a constant flow of lubricant is maintained to flood the bed-ways. The oil overflows from the ways into the central trough to provide an oil bath for the leadscrew and a flow of lubricant over the rack. Surplus oil drains back into a tank whence, after filtering, it is recirculated by a pump.

The saddle is of rigid box construction and has a long area of contact on the bed-ways. Its top surface is inclined rearwards so that coolant can easily flow back into the chip tray and coolant tank.

As can be seen in the lower illustration, the tailstock of the machine is mounted on vertical ways on a structure above and at the rear of the bed. With this arrangement the tailstock can be set in any required position for convenient operation, and it does not obstruct the saddle which can at any time be moved along the full length of the bed. A 9⅞in wide gap at the headstock end of the tailstock slide is sufficiently wide to clear a chuck when used, and to allow work up to 16½in diameter to be swung on the machine.

The lathe is driven through vee belts from a two-speed motor housed in the cabinet leg below the headstock. Two alternative driving motors are available, one motor of 8/12 h.p. gives eighteen spindle speeds from 22 to 1800 r.p.m., and the other of 12/16 h.p. gives a similar number of speeds from 31 to 2500 r.p.m. The hardened and ground spindle runs in anti-friction bearings and is bored 1⅝in diameter with a No. 4 Morse taper bore at the nose end.

In the headstock the feed gears are mounted in a common box with the headstock gears and all moving parts in the headstock are lubricated by pump with an oil filtering device. The feed gears provide thirty-two sliding and surfacing rates from 0·0004in to 0·22in per spindle revolution, and thirty-two Whitworth, metric, module or diametrical pitches can be cut on the machine. In order to avoid wear of the leadscrew and preserve its accuracy a pre-threading device can be used. With this device threads and worms can be rough machined with the drive taken through the feed shaft and rack, the leadscrew being brought into service for the final precision cuts.



**Turret Tailstock and Steady on Copying Lathe**

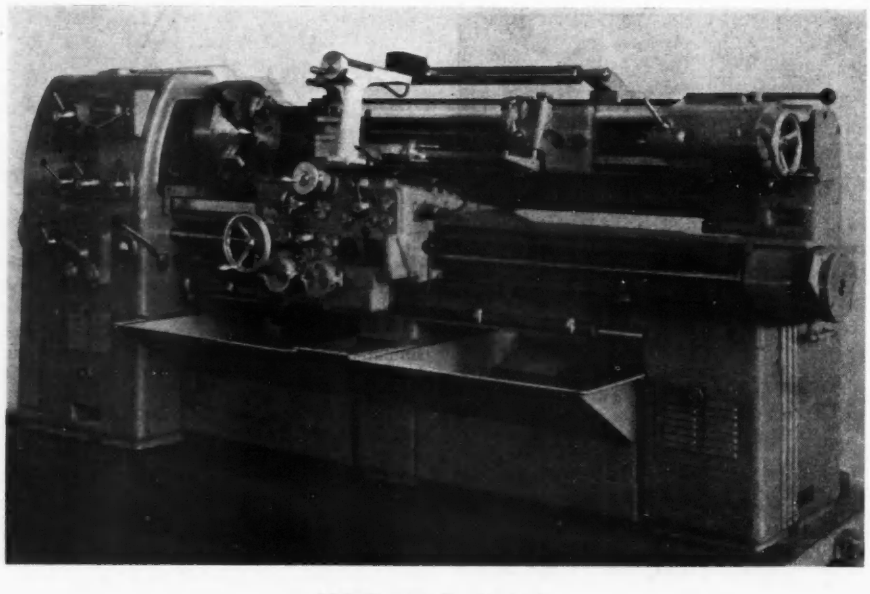
The drives of the sliding and surfacing motions are engaged through electromagnetic clutches in the saddle apron and when the machine is used for copy turning these clutches are actuated by the tracer mechanism. A group of micrometer stops can be set to give precision tripping of the electromagnetic clutches in sliding and surfacing operations. An attachment is supplied for automatically adjusting the rate of feed by the setting of stops when surfacing large diameters or turning shouldered work.

Various attachments can be supplied for fitting on the tailstock slide to increase the operative capacity of the machine and reduce turning times. One of these attachments is a hand-operated in-feed tool slide and a number of these slides can be fixed at predetermined points to enable workpieces to be grooved, faced or undercut whilst turning proceeds. There can also be fitted on the tailstock slide fixed steadies such as that shown on the slide in the machine illustrated. These steadies, whilst supporting the work, do not offer any obstruction to saddle movements and their upper pads can quickly be swung clear when loading and unloading the machine. A universal relieving attachment also available can be used for relief turning of radially, obliquely or axially backed-off tools having straight or spiral plates or helical teeth.

For copy turning purposes the template or master workpiece is mounted between centres or in brackets on the top of the tailstock slide. The tracing head is mounted on a slide on a column on the saddle cross slide and, as already mentioned, movements of the stylus as it follows a profile actuate the electromagnetic clutches controlling the sliding and surfacing motions. Fine settings of the tracing head can be made by precision graduated hand wheel at the end of its slide.

Another of the machines shown in the demonstration is designed for semi-automatic production copying and this machine was fitted with the turret tailstock to be seen in the upper illustration on this page.

A number of tools can be set in this turret tailstock to enable the ends of long components to be machined whilst turning proceeds on a workpiece.



**Multi-Purpose Copying Lathe**

# Industrial and Labour Notes

### Engineering and Shipbuilding Wages

On Thursday of last week, it was announced that the Minister of Labour had appointed two courts of inquiry to examine all the facts and circumstances of the wage disputes in the engineering and shipbuilding industries. Both courts consist of the same people, with Lord Justice Morris as chairman. There are four other members, two being independent members, and two representing employers' and trade union interests respectively. They are Sir Harold Howitt, a chartered accountant ; Mr. H. Lloyd Williams, a barrister and a member of the Industrial Court and Industrial Disputes Tribunal ; Sir Robert Sinclair, a past-president of the Federation of British Industries ; and Mr. C. J. Geddes, general secretary of the Union of Post Office Workers and a member of the T.U.C. general council. The courts were due to begin their public sittings to-day (Friday) and have been asked to complete their reports as speedily as possible.

The announcement about the courts of inquiry came after further conversations which the Minister of Labour had last week with representatives of the Engineering and Allied Employers' National Federation, the Shipbuilding Employers' Federation, and the Confederation of Shipbuilding and Engineering Unions. At a meeting of the management board of the Engineering Employers' Federation, which was held on Wednesday of last week, the view was reiterated that the unions' claim for a 15 per cent wage increase was not justified, and it was added that as the facts concerning exports had not altered, any consideration of an increase was precluded. The Minister saw representatives of the Confederation of Shipbuilding and Engineering Unions on Thursday morning of last week and he asked them to consider suspending the ban on overtime and limitation of piecework which it had been decided to operate from January 18th. In a statement issued by the Ministry after the meeting reference was made to the serious consequences to the general economy of the country, to export trade and to full employment which would result from the action threatened by the unions.

Last Monday, the Confederation's executive met in London, and after discussion decided to postpone the ban on overtime and piecework until the courts of inquiry had reported. The Confederation stated that it realised that the "decision of the Minister to establish courts of inquiry was the only ultimate course open to him in the event of the employers continuing their refusal to negotiate."

### Railway Freight Charges

The British Transport Commission has made an application to the Minister of Transport for authority to increase railway freight charges and dock and canal charges at the earliest possible date by 10 per cent, but with a limitation of 10s. per ton in the case of merchandise by freight train and perishable traffic by passenger train. In a statement giving the reasons why it has been compelled reluctantly to make this application, the Commission explains that it is not easy, in view of future uncertainties, to make precise forward estimates either of expenditures or earnings. In consequence the Commission has limited its request to the minimum definitely required. It has accordingly asked the Minister for an increase of 10 per cent, which, it is hoped, will fill the current budget gap of British Railways. The yield from the proposed increase in railway freight charges is estimated at about £23,000,000 in a full year ; from increased dock and canal charges, about £1,000,000 to £2,000,000.

The last two increases in these charges occurred in December, 1951, and December, 1952, and amounted to 10 per cent and 5 per cent respectively. The Commission had hoped, after the last increase, that stability had been reached ; but, it says, as a result of still further rises in costs during 1953, and in spite of the greater efficiency which has been achieved, a further increase in charges is now unfortunately inevitable. The rise in coal and steel prices early in 1953 has cost between £4,000,000 and £5,000,000, and changes in the price of steel scrap and certain other commodities have cost about £2,000,000 more. The charge for depreciation continues to rise because the new assets brought into service cost more than the old ones they replace, and additional interest must be provided for the same reason. It is also being found necessary to make a substantial increase in the maintenance expenditures charged to revenue. Finally, the recent award by the Railway Staff National Tribunal of 4s. a week increase in salaries and wages is estimated to cost between £6,000,000 and £7,000,000 a year, and in addition there is the cost of financing the new pension scheme instituted for the wages grades.

Whether, the Commission's statement adds, the railway budget can be kept in balance on the 10 per cent increase now asked for must depend on various factors. Among them there is the future cost of coal and engineering products ; the increasing competition which may seriously affect railway receipts in certain categories of traffics ; and perhaps most important the increased efficiency for which the Commission is determined, in conjunction with the trade unions, to make a renewed and vigorous drive. Any action on passenger fares, including London transport road and rail services as well as road and rail services elsewhere, must depend on a number of factors, and particularly upon the outcome of negotiations still in progress.

### Changes in Wage Rates

The Ministry of Labour has stated that changes in rates of wages, reported as taking effect during the month of November last, resulted in an aggregate increase of approximately £109,000 in the weekly full-time wages of 457,000 workpeople and in a decrease of about £21,000 for 98,000 workpeople. The decreases, which operated under sliding scale arrangements based on the index of retail prices, affected workers in the boot and shoe manufacturing industry.

Those receiving increases included workers in paint, varnish and lacquer manufacturing, the electric cable making industry, and in electricity supply undertakings. In paint, varnish and lacquer manufacturing there were increases in the minimum rates of 4s. a week for men and 2s. 9d. or 3s. 3d. for women, according to occupation or period of employment. The increases in the electric cable making industry were a 1d. an hour for men and ¾d. for women, and in electricity supply undertakings there was an increase of 1d. an hour for shift workers.

During the eleven months, January to November, 1953, changes in wage rates resulted in an aggregate increase of £2,242,900 in the weekly full-time wages of 8,209,500 workpeople. In the corresponding months of 1952 there was a net increase of £4,321,000 in the weekly full-time wages of 11,180,000 workpeople. The changes in November last did not affect the wage index (June 30, 1947=100), which stood at 137 for all workers. The index rose by one point in September, since when there has been no change.

### Wages and Incentives

This week there has been published by the Institute of Cost and Works Accountants a report entitled *Employee Remuneration and Incentives*. It has been prepared from information collated by the Institute's technical committee, and was submitted in draft to a National Cost Conference which was held in London last May.

The six main sections of the report deal with the history of wage systems, underlying principles, methods of wage fixing, reasons for the choice of various wage systems, factors influencing methods of remuneration and incentives, and present-day trends. Early in its treatment of the subject the report says that the structure of wages in this country at the present time presents a picture of apparent chaos. Between industry and industry, job and job, wage levels vary considerably, "but in accordance with no visible principle and without relation to the value to the community of the work done, the economic requirements of the country as a whole, or even the needs of particular industries and their capacity to pay. This system, or lack of system, is widely felt to be unsatisfactory and there is now an increasing demand for some form of national wages policy which will remove anomalies and introduce a central principle." How this policy is to be determined, the report comments, and how it could be implemented, are questions on which agreement is still beyond reach.

In the section which deals with present-day trends, the report expresses the view that if a national wage policy were in force there is a probability that it would have the effect of reducing incentive to extra effort. One of the signs of the times, the report says, is the increase in the open contravention of agreements, accompanied by demands often made deliberately extortionate in the hope that a compromise agreement will yield more than is actually expected. In spite of the strides of the last fifty years, the report continues, and of the negotiating machinery that now exists for dealing with disputes, "not a day passes without some fresh demand for wage increase or adjustment. The worker has now a stronger bargaining power than he ever had before, and there is generally a state of near-equality between the employer and the worker." In fact, it is added, there is the danger of the other extreme—that is, of excessive demands from the side of the worker and the enforcement of those demands until they result in hardship to the public.

The outstanding need to-day, the report concludes, is greater productivity, which is another way of saying more goods for less work. A remuneration system, it is claimed, must recognise this obvious truth and must contain the incentive for its achievement. The report suggests that a stage in the history of wages now appears to have been reached when new ideas are being sought and experimented with in an endeavour to obtain a fair arrangement acceptable both to employer and employee.

The price of this report is 7s. 6d. It may be obtained from the Institute of Cost and Works Accountants, 63, Portland Place, London, W.1.

### Industrial Disputes

Compared with some of the earlier months of last year, there was a decrease in the number of working days lost in the United Kingdom during the month of November on account of stoppages of work through industrial disputes. The number of stoppages reported to the Ministry of Labour as beginning in November was 189, and to them must be added thirteen stoppages which were already in progress. In these 202 stoppages, 39,300 workpeople were involved, directly and indirectly, during November, and the aggregate number of working days lost was 93,000.

In the eleven months, January to November last, the number of stoppages of work through disputes, reported to the Ministry of Labour, was 1624. They involved 274,900 workpeople and resulted in an aggregate loss of 1,053,000 working days. In the comparable period of 1952, there were 1626 stoppages reported, involving 361,800 workpeople, and causing a loss of 1,657,000 working days.

### Index of Industrial Production

The central statistical office of the Treasury has estimated provisionally that the index number of industrial production (1948=100) for all industries in October last was 128, compared with 125 in September. In 1952 the figures for the corresponding months were 119 in October and 115 in September. The biggest improvement in October last, compared with a year earlier, was in the manufacturing industries, the index numbers being 131 and 121 respectively. The index number for mining and quarrying in October was 117, which was the same as in October, 1952. The Treasury says that, on the basis of information so far received, the index for all industries in November, 1953, is expected to be 130 or 131.

# Notes and Memoranda

## Rail and Road

TRIAL RUNNING OF ELECTRIC LOCOMOTIVE.—The first of seven 2500 h.p. six-axle electric locomotives under construction for the Manchester-Sheffield-Wath electrification scheme recently started trial running between Dukinfield and Crowden. These locomotives, which each weigh over 100 tons, will be used for hauling both heavy freight and passenger trains. The mechanical parts of the locomotives are being built at the Gorton locomotive works of British Railways (Eastern Region) and the electrical equipment is being supplied and erected by Metropolitan-Vickers Electrical Company, Ltd.

PROTECTION OF NEW ROAD FORMATIONS.—The Department of Scientific and Industrial Research has published Road Note 17, entitled "Protection of Subgrades and Granular Bases by Surface Dressing," which has been prepared by the Road Research Laboratory. This pamphlet points out that the prepared formation of a new road can be badly damaged during wet weather before the pavement is laid, as the surface of the subgrade, softened by rain, is easily churned up by construction traffic. Such harmful effects can be avoided by protecting the formation by the application of a surface dressing. The note describes the kinds of soil formation and base suitable for treatment, and the preparation and drainage of the surface of the formation. Details are given of the number of dressings required and the classes of binder and aggregate with their appropriate rates of application.

## Air and Water

NEW OIL TANKERS.—We are informed by the Anglo-Iranian Oil Company, Ltd., that nine oil tankers, totalling 190,000 tons deadweight, are expected to be launched this year for the British Tanker Company, Ltd., and that three of the ships are each designed to carry 32,000 tons.

MANŒUVRING TRIALS.—During trials of the 18,000-ton oil tanker "Esso Oxford," various ship movements, including turning trials, were recorded by means of the Decca Navigator. Readings were taken at ten-second intervals from the gyro compass and the Decometers so that the ship's turning circles could be plotted and also other manœuvres.

AWARD FOR SIR WILLIAM FARREN.—Sir William Farren, C.B., F.R.S., technical director of A. V. Roe and Co., Ltd., Manchester, has been elected a Foreign Honorary Fellow of the International Institute of Aeronautical Sciences, Inc. This is America's highest aeronautical honour for a non-national and only one such award is made annually after a secret ballot. Sir William, who is sixty-one, was born in Cambridge. He receives the award for his "contribution to the advancement of aeronautics."

## Miscellanea

RETIREMENT OF MR. G. TILGHMAN RICHARDS.—Mr. G. Tilghman Richards, M.I.Mech.E., is retiring on January 20th from the Science Museum, South Kensington, where he has served as an official guide lecturer on the engineering and industrial collections since 1933.

66MW TURBO-ALTERNATOR SET FOR CALGARY.—On page 38 of last week's issue we referred to a contract involving a 66MW steam turbo-alternator set for Calgary. We are informed that the inlet steam conditions will be 850 lb per square inch at 900 deg. Fah., and not 1250 lb per square inch at 950 deg. Fah. as stated.

SELLING PRICES FOR TUNGSTEN ORES.—The Ministry of Materials has announced that as from January 5th, its selling price for tungsten ores of standard 65 per cent grade and ordinary quality has been reduced as follows: wolframite from £9 5s. to £8 5s., and scheelite from £8 10s. to £7 10s., per long ton unit delivered consumers' works.

MR. C. H. NUNN.—We regret to announce that Mr. C. H. Nunn, manager of the transformer works of the General Electric Company, Ltd., died at the works on December 22, 1953. Mr. Nunn was born at Clacton-on-Sea in 1897 and saw active service in the first world war. After demobilisation he studied engineering at the Northampton Engineering College and joined the switchgear drawing-office of the G.E.C. at Witton in 1924. Twelve months later he transferred to the transformer department and became chief designer in 1934, subsequently being appointed manager of that works in 1938.

LECTURES ON ELECTRONICS INSTRUMENTS AND PROCESS CONTROL.—A short course of six lectures on the subject of electronics instruments which has been arranged by the South-East London Technical College will start on Jan. 26th. The lectures will be concerned with signal generators, valve voltmeters, magnetic amplifiers, microwave techniques, electronic computers, and measurement of physical quantities. Another course on automatic process control which starts on March 9th is designed to be of interest to engineers concerned with process control and has been arranged in conjunction with Elliott Brothers (London), Ltd.

MOND NICKEL FELLOWSHIPS.—The Mond Nickel Fellowships Committee announces that it has made the following awards for 1953:—Mr. J. E. Benson (Metropolitan-Vickers Electrical Company, Ltd.), to study the technique and interpretation of results of non-destructive testing of metal components in the United Kingdom, on the Continent and in the U.S.A. and Canada; Mr. K. Blackburn (Dorman, Long and Co., Ltd.), to study hot metal basic open-hearth practice in Great Britain, on the Continent and in the U.S.A. and Canada, with particular reference to mixer furnace operation, refractories, instrumentation and pitside practice; and Mr. N. B. Pratt (Broken Hill Proprietary Company, Ltd.), to study the technical and economic aspects of recent advances in the erection and operation of integrated iron and steel works in Great Britain, on the Continent and in the U.S.A. and Canada.

PIMLICO DISTRICT HEATING UNDERTAKING.—It has been pointed out that, in our abstract of the paper, "Pimlico District Heating Undertaking" (THE ENGINEER, December 25, 1953, page 850), we reproduced an error in Fig. 1. The input shown in the bottom left-hand corner of this diagram should have been 1421, instead of 1425.

RETIREMENT OF MR. ROBERT RAINIE.—The retirement has been announced of Mr. Robert Rainie, the manager of the London organisation of Harland and Wolff, Ltd. Mr. Rainie was born at Newtown-on-Ayr in 1884, and following his education at Ayr Academy and Glasgow Technical College he served his apprenticeship with Sir William Arrol and Co., Ltd. When in 1921 Harland and Wolff, Ltd., decided to create twelve establishments on the Thames, Mr. Rainie was appointed assistant manager of the organisation. In 1925 he was promoted to take care of commercial and technical general management of the organisation—now comprising six factories.

OBITUARY.—We have learned with regret of the death, recently in Spain, of Mr. Patrick Danielsson, chief of the Atlas Diesel project department, Stockholm. Mr. Danielsson, who was sixty-five, had been with the Atlas organisation for twenty-five years, during which time he had made a particular study of tunnelling methods in connection with hydro-electric schemes and other civil engineering projects. Before joining the Atlas organisation, Mr. Danielsson was for some time chief engineer of the Swedish Government coal mines in Spitzbergen. We regret to have to record also the death of Mr. S. H. Heywood, founder and chairman of S. H. Heywood and Co., Ltd., Reddish, Stockport. He was eighty-five.

NATIONAL POWER FARMING CONFERENCE.—The programme for the fourth National Power Farming Conference, which is to be held at Cheltenham next month, has now been issued. The conference will begin at 2 p.m. on Tuesday, February 9th, and will continue until Thursday evening, February 11th. The subjects to be discussed include manpower and machines; grain handling and storage; machinery for hill farming; land drainage; machinery manufacturers' problems; German agricultural machinery design; economics of machine ownership, and research on electricity in agriculture. Full details of the conference may be obtained from *Power Farmer*, Dorset House, Stamford Street, London, S.E.1.

RESISTANCE WELDING.—We have received from Johnson, Matthey and Co., Ltd., a copy of its publication, *Mallory Resistance Welding*, which has recently been revised. The booklet makes a brief survey of the range of "Mallory" materials, their applications and availability, and deals in turn with the four major resistance welding processes—spot, seam, projection and flash and butt welding—giving advice on the choice of material, electrode design and construction, and recommended procedure for obtaining maximum efficiency from machine, material and electrode. To supplement the information given in the booklet the firm proposes to issue a series of data sheets dealing in greater detail with the questions of material selection and design.

"WADE'S TABLES."—A new edition of *Wade's Tables* for overhead transmission line engineers has just been issued by Gabriel, Wade and English, Ltd., Southern Chambers, Waltham Street, Hull. These tables are designed to meet the requirements of all countries where red fir and similar timbers are used to support overhead power lines. They have developed from the original tables issued in 1907 and are based upon the extensive tests carried out on single "A" and "H" poles by Professor Goodman and Mr. Christopher Wade. As the regulations governing the design of overhead power lines vary between countries the net safe load tables given in previous editions of the book have been omitted, but the information on theoretical breaking loads has been retained. Tables are now included dealing with varying wind loads.

SHORTAGE OF SCIENCE TEACHERS.—A private conference, called by the Federation of British Industries, to discuss the problem of the shortage of science teachers, its effects on industry, and possible solutions, is to be held at the Institution of Electrical Engineers, Savoy Place, London, on Thursday next, January 14th. Members of the conference will be drawn from industrial firms and from the universities, public and secondary schools, technical colleges, central and local education authorities. Sir Harry Pilkington, president of the F.B.I., will open the conference. At the morning session Sir Charles Morris, Vice-Chancellor of the University of Leeds, will speak on "Science Teachers—the Demand and the Supply"; Dr. A. W. Barton, headmaster of the City of London School, on "The Present Position in the Schools and Some Possible Consequences"; and Dr. P. Dunsheath, chairman of the F.B.I. education committee, on "The Industrial Viewpoint." The afternoon session will be devoted to general discussion.

## Contracts

BLAW KNOX, Ltd., 90-94, Brompton Road, London, S.W.3, has received a contract to the value of approximately £300,000 for the design and supply of transmission line towers for Norway. The contract was placed by Oslo Lysverker for its new 220kV single-circuit line from Hol to Oslo.

## Personal and Business

BRITISH PAINTS, Ltd., states that its export division is now located at Crewe House, Curzon Street, London, W.1.

DRYSDALE AND CO., Ltd., Yoker, Glasgow, announces the appointment of Mr. Neil Munro Niven as joint managing director.

MR. H. DAVIES has been appointed a director of W. G. Bagnall, Ltd., Stafford. He has been general manager of the company since 1947.

MR. E. S. WADDINGTON, of Philips Electrical, Ltd., has been re-elected vice-chairman of the arc welding plant section of Beama.

MR. FRANK TAYLOR, chairman of Taylor Woodrow, Ltd., has been elected chairman of the export group for the constructional industries.

HOPKINSONS, Ltd., Huddersfield, announces the retirement of Mr. F. B. Mills, representative in the Yorkshire area. His successor is Mr. P. K. Walker.

BRUCE PEEBLES AND CO., Ltd., Edinburgh, announces the appointment of Mr. George Henderson as sales manager, and Mr. N. L. Jones as London manager.

THE CLAN LINE announces that Captain F. J. E. Houghton, master of the Clan Shaw, has been appointed commodore of the fleet in succession to Captain A. R. Cossar.

THE MINISTER OF LABOUR, after consultation with the National Joint Council for the Port Transport Industry, has reappointed Lord Crook as chairman of the National Dock Labour Board for 1954.

JOHN FOWLER AND CO. (LEEDS), Ltd., announces the retirement from active business of Mr. J. C. Wood, after nearly fifty-two years in the company's service. Mr. Wood will continue to serve on the board.

MR. A. B. LLOYD, sales director of F. H. Lloyd and Co., Ltd., Wednesbury, has taken a temporary appointment as a steel foundry adviser to the Government of India in connection with a survey of industrial capacity.

THE CUNARD STEAMSHIP COMPANY, Ltd., states that Captain H. Grattidge, has been succeeded as commodore of the Cunard fleet by Captain C. I. Thompson, who is at present in command of the "Queen Mary."

SIR JOHN HACKING, M.I.E.E., who recently retired from the position of deputy chairman (operations) of the British Electricity Authority, has joined Messrs. Merz and McLellan, 32, Victoria Street, London, S.W.1, as a consultant.

THE IRON AND STEEL HOLDING AND REALISATION AGENCY announces that the sale has been completed to J. Brockhouse and Co., Ltd., of the entire issued share capital in the District Iron and Steel Company, Ltd., for the sum of £600,000.

MONSANTO CHEMICALS, Ltd., announces the formation of a wholly owned subsidiary entitled Monsanto Plastics, Ltd. Mr. Gilbert Dodd has been appointed general manager of the new company, the address of which is Victoria Station House, London, S.W.1.

SIR HARRY BROWN, M.I.E.E., has retired from the chairmanship of the British General Electric Company, Pty., Ltd., of Australia. Mr. T. E. Morgan has been appointed chairman and managing director, and Mr. A. T. Bridge, Mr. R. J. Darton and Mr. C. Drabble have joined the board.

MR. R. W. HAWKEY, M.I.C.E., sole partner in the consulting firm of Sir Cyril Kirkpatrick and Partners, has joined Messrs. Scott and Wilson, 47, Victoria Street, London, S.W.1, and the practice is being continued under the title of Scott and Wilson, Kirkpatrick and Partners. Mr. F. M. Bowen, M.I.C.E., has been taken into the new partnership.

MR. J. P. HUNT has been appointed joint managing director of the Staveley Coal and Iron Company, Ltd. He has consequently resigned his appointment as chairman and managing director of the Hallamshire Steel and File Company, Ltd., but will continue to serve on the board of that company until its future ownership has been determined.

THE MARCONI INTERNATIONAL MARINE COMMUNICATION COMPANY, Ltd., announces the appointment of Mr. J. W. Dalton as manager of its Grimsby depot. Mr. F. W. J. Grinter, who has had charge of the company's depots at both Hull and Grimsby since last July, will continue to be responsible for contracts business in both areas for the time being.

MR. ANNOLE H. HUMAN, for many years sole partner in the consulting firm of McLellan and Partners, 32, Victoria Street, London, S.W.1, has retired. The practice is being carried on by Sir Henry Clay, Bart, Mr. G. N. Hewett, and Mr. T. B. Rolls, who, together with the partners of Merz and McLellan, are the new partners. Mr. Human will continue his association with the firm as a consultant.

MR. J. W. BAILLIE has resigned from his position as managing director of Horseley Bridge and Thomas Piggott, Ltd., but will continue to serve on the board. Mr. J. S. Christie and Mr. Vincent Senior have been appointed joint managing directors. Mr. Senior has relinquished his position as managing director of Carter-Horseley (Engineers), Ltd., but will remain on the board as deputy chairman. Mr. Christie has also become a director of that company. Mr. N. E. W. Baker and Mr. B. Vincent Smith have been appointed joint managing directors of Carter-Horseley (Engineers), Ltd.

# British Patent Specifications

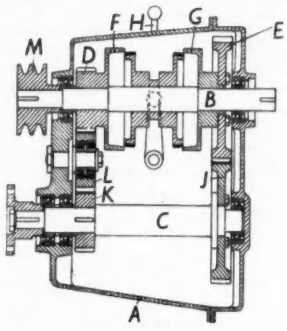
*When an invention is communicated from abroad the name and address of the communicator are printed in italics. When an abridgment is not illustrated the specification is without drawings. The date first given is the date of application; the second date, at the end of the abridgment, is the date of publication of the complete specification.*

*Copies of specifications may be obtained at the Patent Office Sales Branch, 15, Southampton Buildings, Chancery Lane, W.C.2, 2s. 8d. each.*

## MARINE ENGINEERING

**700,382.** May 5, 1951.—REVERSING GEAR MECHANISM FOR SHIPS, The Enfield Cycle Company, Ltd., Enfield Works, Hewell Road, Redditch, Worcester, and Clarence Frank Nossiter, of the company's address.

The invention relates to reversing gear mechanism more particularly for use in ships and its object is to provide a mechanism, giving a variety of gear ratios, both forward and reverse, according to the requirements of a particular ship, the mechanism permitting full engine torque, forward or in reverse, for long periods: a pair of such gearboxes may be utilised in ships when contra-rotating propellers are required without resorting to oppositely



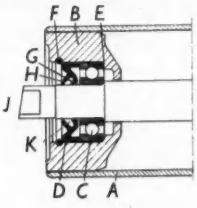

No. 700,382

rotating engines. As the drawing shows, the gearbox *A* is provided with powered input and output shafts *B* and *C* respectively. On the input shaft there are freely mounted two gear wheels or pinions *D* and *E*, each of which carries a clutch element *F* and *G* which can be selectively engaged by a clutch operated by a lever *H*. At the input end of the input shaft the gear wheel *E* meshes directly with the gear wheel *J* on the output shaft, whereas at the remote end of the input shaft the gear wheel *D* meshes with the corresponding gear wheel *K* on the output shaft only by way of an idler gear wheel *L*. The reverse drive is derived from the input shaft *B* to the output shaft *C* directly through the positively engaged gears *E*, *J*, and the forward drive is obtained through the idler *L* so that the normal forward drive is in the same direction as the engine shaft, the idler gear being capable of being aligned or offset with its complementary wheels according to its setting in the box. In this manner various forward and rearward ratios may be obtained from a common box by altering or interchanging the wheels and, if necessary, altering the setting of the idler wheel to accommodate its associate gear wheels. A pulley *M* may be attached to an extension of the input shaft through the gear casing to provide an auxiliary drive to operate a bilge pump, dynamo or compressor or the like. It is also possible to assemble either a reversing gear with a 1 : 1 ratio or with a 2 : 1 reduction gearing within the same gear casing by correct selection of gear wheels, without disturbing the forward drive and by rearranging all the five gear wheels it is possible to assemble the same gearbox with, say, 1 : 1 forward gearing and a 2 : 1 reverse gearing, or vice versa, or other desired ratios.—*December* 2, 1953.

## BALL AND ROLLER BEARINGS

**700,811.** October 25, 1950.—SEALING DEVICES FOR BALL AND ROLLER BEARINGS, Gebr. Eickhoff, Maschinenfabrik u. Eisengiesserei G.m.b.H., Bochum, Germany.

An object of the invention is to provide a sealing device which requires no spring to hold the flange edges against the shaft and can be made in compact form. As shown in the drawing, a roller body *A* is carried by a bearing housing *B*, within which are arranged, side by side, a ball bearing *C* and a rubber sealing device *D*. The bearing and device are located between a shoulder *E* in the housing and a resilient retaining ring *F*, which presses the bearing and the sealing device against one another and to the shoulder. The rubber device has an outer annular portion, of which one side face lies against the outer race of the bearing *C* and the other side face bears against the ring *F*. This outer annular portion merges into a short annular web, which is frusto-conical in shape and terminates in two narrow flanges *G* and *H*, which are laterally displaced. Both these flanges are inclined with respect to the shaft *J* and are provided with knife edges and embrace and press against the shaft, forming between themselves and the shaft an annular space *K*, which widens towards the shaft. Lubricant can pass from the bearing under the knife edge of the inner flange *G* and into the space *K*, where

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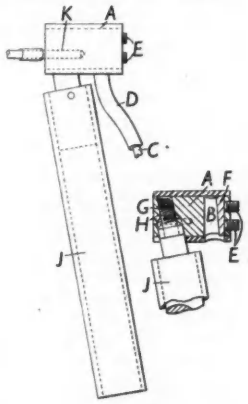
it is collected. Furthermore, the edge of the outer flange *H* is moistened by the lubricant, which reaches the space *K* without this lubricant passing in quantity under the edge. Even when the shaft moves to and fro passage of lubricant beyond the flange *H* does not take place owing to the space *K*.—*December* 9, 1953.

## WELDING AND CUTTING

**700,839.** December 14, 1951.—HOLDERS FOR WELDING ELECTRODES, Welding Rods, Ltd., 76, Attercliffe Road, Attercliffe, Sheffield, 9. (*Inventor: John Hector Bull.*)

As shown in the drawing, a short cylindrical block *A* has a transverse hole *B* near its rear end to receive the conductor *C* of a supply lead *D*, two socket screws *E* serving to press a clamping pad *F* on to the

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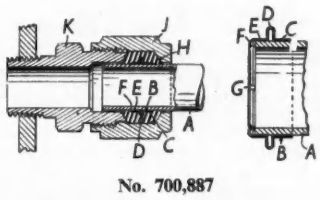
conductor. A transverse hole *G* near the front end of the block *A* is tapped to receive the reduced screwed end *H* of a handle *J*, the hole being inclined to bring the block *A* into suitable operating position with respect to the handle. The general construction and the connections for the stripped electrode *K* are shown in the drawing.—*December* 9, 1953.

## TUBE AND PIPE COUPLINGS

**700,887.** October 1, 1951.—FITTINGS OR CONNECTIONS FOR TUBING, Chicago Forging and Manufacturing Company, 2000, Southport Avenue Chicago, 14, Illinois, U.S.A. (*Inventor: Dibrell Pryor Hynes.*)

The invention relates to an improvement in fittings or connections for tubing, particularly, but not exclusively, for securing relatively thin tubing to joint members. Referring to the drawings, *A* is a tube end and *B* is a ferrule having a solid non-split cylindrical sleeve portion *C*, and *D* a projection

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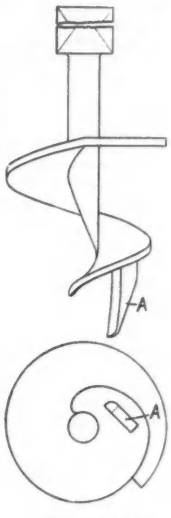
shown in the form of a circumferential rib. At the opposite side of the rib is a circumferential portion *E* which terminates in an inwardly bent lip *F* and is slotted as at *G*, the slots extending through the lip and into the cylindrical portion *E*. *H* is a washer or ring of rubber. In making a connection, the washer *H* is slipped over the ferrule *B* and is then subjected to pressure to compress it firmly against the surface of the tube, for example, by a nut *J*. It will thus be seen that when the members *J* and *K* are screwed together, they provide a pressure chamber in which the rubber ring is confined. Under compression, the entire interior of the pressure chamber is filled by the ring, which can be put under substantial pressure. Modified fittings are also shown in the specification.—*December* 9, 1953.

## CIVIL ENGINEERING

**700,632.** March 9, 1951.—BORING TOOLS FOR EARTH, National Research Development Corporation, 1, Tilney Street, London, W.1. (*Inventors: Frederick George Taylor and Stanley Swinney.*)

The invention relates to boring tools for earth intended primarily for drive by a rig which imposes some degree of axial location of the tool. The borer illustrated in the drawing is of the "corkscrew" type, in which the stem, instead of continuing beyond the leading end of the blade to form a central spike, tapers away to nothing at the end of the blade and a separate spike *A* is provided, away from the centre. As shown, the spike is of rectangular section, its rear edge being inclined towards the tip. It is a little behind the leading end of the blade and the long side of the rectangular section is set at right angles to the radius through the leading edge at the tip of the spike, and from the tip the leading edge is sloped back a little as may be seen in the upper view. It will be seen from the lower view that the leading edge of the spike is at about two-thirds of the radius of the blade at

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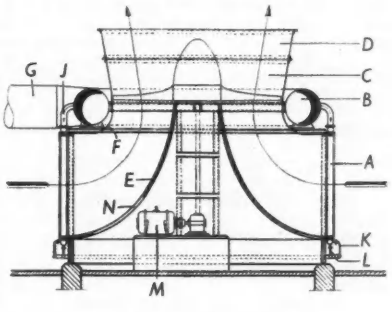
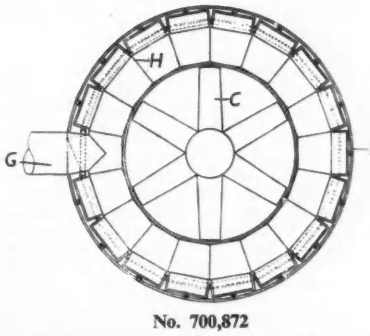
the location of this edge of the spike and at about one-third of the maximum radius of the blade. The proportions shown have been found suitable, so that with a tool for boring a 9in hole the length of the spike is about 4in, but these proportions are not critical and the length of the spike need not be directly proportional to the diameter of the hole to be bored.—*December* 9, 1953.

## STEAM CONDENSERS

**700,872.** March 22, 1951.—AIR-COOLED CONDENSERS, Elisabeth Ferdinande Happel, *née Schulenberg*, 3, Gederbach, Herdecke-Gedern, Germany.

This invention relates to particularly large plants. For an installation of about 25,000kW, corresponding to an amount of steam of about 100 tons to be condensed per hour and a vacuum of about 92·5 per

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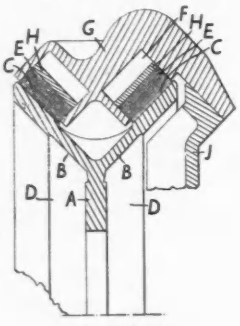
cent based on an annual mean external temperature of 10 deg. Cent., an air-cooled condenser of about 25m in diameter, with a condenser element height of about 6m to 7m and a depth of about 250mm, with

a blower about 16m in diameter and a diffuser of about 5m to 6m in height is needed. In the drawings *A* shows the air-cooled condenser elements, *B* the annular steam distribution pipeline, *C* the blower and *D* the diffuser. The condenser elements form the jacket of a cylindrical shaft. They preferably consist of elliptical ribbed tubes of small tubular cross section, and with close rib arrangement. To the bottom end of the condenser is connected the guide surface *E*, which ends near the hub of the blower. To the upper end of the condenser elements is connected a guide surface *F*, which ends near the outer periphery of the blower or merges into the diffuser *D*. The steam to be condensed is supplied through the pipe *G* of the annular pipeline *B*. This consists of individual sections *H* of trapezoidal shape in the horizontal section. The division into sections corresponds to the arrangement of the condenser elements. The connecting pieces *J* may also be provided at other points on the annular pipeline. *K* is the air suction pipe and *L* the condensate discharge pipe from the condenser. The driving motor *M* for the blower *C* is accommodated in the hollow space below the guide surface *E*. This guide surface has an access and mounting aperture *N*, which is normally closed by a cover.—*December* 9, 1953.

### ROAD TRANSPORT

**700,724.** October 6, 1951.—DISC BRAKE FOR VEHICLES, Girling, Ltd., Kings Road, Tyseley, Birmingham, 11. (*Inventor: Thomas Kemp Mace.*)

In the arrangement shown in the drawing the rotatable member of the brake is a disc *A* having on its periphery two diverging flanges *B* providing the braking surfaces *C*, which are substantially at right angles to each other. The flanges are thickened over the part which is engaged by the braking pads and are stiffened by radial ribs *D* extending between the disc and the outer surfaces of the flanges. The braking surfaces are engaged by friction pads *E*

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which are mounted in hydraulic cylinders *F* in a housing *G*, the axes of the cylinders being at right angles to the braking surfaces. Each pad is backed by a steel disc *H* and the closed rear ends of the cylinders are connected to each other and to a source of liquid under pressure, such as a pedal-operated master cylinder for forcing the pads into engagement with the braking surfaces. The housing *G* is secured to a flanged torque-taking anchor plate *J*, secured to any convenient stationary member on the vehicle chassis. An alternative design is also shown in the specification.—*December* 9, 1953.

## Technical Reports

*Recommended Definitions of Terms Used in Power System Studies* (Ref. V/S1). The British Electrical and Allied Industries Research Association, Dorking Road, Leatherhead, Surrey. Price 15s., postage 4d.—Definitions of terms used in power system studies are drawn up in this report for submission to the British Standards Institution with a view to their incorporation in a B.S glossary.

*The Dielectric Properties of Phenol-Formaldehyde Resin* (Ref. L/T273). By E. Rushton. The British Electrical and Allied Industries Research Association, Dorking Road, Leatherhead, Surrey. Price 7s. 6d., postage 3d.—The dielectric properties of pure phenol-formaldehyde resin of the thermosetting type were measured as a function of frequency over the range 50 c/s to 24,000 Mc/s. The power factor increases continuously with increasing frequency, but it does not pass through a maximum. The behaviour of the resin in the dried condition is mainly determined by the polar hydroxyl groups in it. Water which has been absorbed from the atmosphere or produced by the condensation reaction during hardening has a marked influence on the dielectric behaviour at very high frequencies as well as at low frequencies, and the polar water molecules appear to act in the same way as the polar OH groups in producing dielectric losses in the phenolic resin. The work was carried out at the National Physical Laboratory.

## Catalogues

B. ELLIOTT AND CO., Ltd., Victoria Works, Willesden, London, N.W.10.—Catalogue on the complete range of "Selecta" electric tools.

THE BIRTLEY COMPANY, Ltd., Birtley, County Durham.—Booklet describing earth-moving equipment, bulldozers and scrapers.

THE DERBYSHIRE SILICA FIREBRICK COMPANY, Ltd., Friden, Hartington, Derbyshire.—Copy of "Siliceous and Fireclay Pamphlet."

STANDARD TELEPHONES AND CABLES, Ltd., North Woolwich, London, E.16.—Booklet giving details of electronic telegraph distortion measuring equipment.

THE MORSE CHAIN COMPANY, Ltd., Letchworth, Herts.—New publication dealing with Morse round pin series bush roller driving chains from ⅜in to 1½in pitch.

THE GENERAL ELECTRIC COMPANY, Ltd., Magnet House, Kingsway, London, W.C.2.—List of products, G.E.C. and associated manufacturing companies.

STURTEVANT ENGINEERING COMPANY, Ltd., Southern House, Cannon Street, London, E.C.4.—Publication No. 5602, Sturtevant turbo-exhausters and blowers for industrial service.

METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., St. Paul's Corner, 1–3, St. Paul's Churchyard, London, E.C.4.—Catalogue listing Metrovick industrial lighting fittings.

THE REALM ENGINEERING WORKS, Ltd., 267, Whitehorse Lane, South Norwood, London, S.E.25.—Leaflets on 10in stroke "Royal" shaping machines and 6in heavy-duty machine vices.

## Forthcoming Engagements

*Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of their insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases, the* TIME AND PLACE *at which the meeting is to be held should be clearly stated.*

### BRITISH INSTITUTION OF RADIO ENGINEERS

*Wed., Jan. 13th.*—N.E. SECTION: Neville Hall, Westgate Road, Newcastle upon Tyne, Short Papers by Students, 6 p.m.
*Wed., Jan. 20th.*—SCOTTISH SECTION: Department of Natural Philosophy, The University, Edinburgh, Film Evening, 7 p.m.
*Thurs., Jan. 21st.*—SCOTTISH SECTION: Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, Film Evening.
*Tues., Jan. 26th.*—W. MIDLANDS SECTION: Technical College, Wulfruna Street, Wolverhampton, "Microwave Measuring Instruments," P. M. Ratcliffe, 7.15 p.m.

### CLEVELAND INSTITUTION OF ENGINEERS

*Mon., Jan. 11th.*—Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough, "Flame Radiation and O.H. Productivity," M. W. Thring, 6.30 p.m.
*Mon., Jan. 18th.*—Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough, "Engineering and Operational Aspects of New Rolling Mill Plant at Normanby Park, Steelworks," 6.30 p.m.

### INSTITUTE OF FUEL

*Tues., Jan. 12th.*—Waldorf Hotel, Aldwych, London, W.C.2, "New Carbonisation Processes Under Development and Their Relation to Established Practice," D. T. Barritt and T. Kennaway, 5.30 p.m.

### INSTITUTE OF METALS

*Tues., Jan. 12th.*—S. WALES LOCAL SECTION: University College, Singleton Park, Swansea, "Continuous Casting," J. Crowther, 6.45 p.m.
*Mon., Jan. 18th.*—SCOTTISH LOCAL SECTION: Visit to the Research Laboratories of Babcock and Wilcox, Ltd., Renfrew.

### INSTITUTE OF NAVIGATION

*Fri., Jan. 15th.*—Royal Geographical Society, 1, Kensington Gore, London, S.W.7, "Methods of Air and Surface Navigation," E. W. Anderson, D. H. Sadler, R. B. Michell and E. Fennessy, 5 p.m.

### INSTITUTE OF PETROLEUM

*Wed., Jan. 13th.*—26, Portland Place, London, W.1, "The Stability and Compatibility of Fuel Oil and Diesel Fuel," C. W. G. Martin and D. R. Bailey, 5.30 p.m.

### INSTITUTE OF ROAD TRANSPORT ENGINEERS

*To-day, Jan. 8th.*—S. WALES GROUP: S. Wales Institute of Engineers, Cardiff, "The Cost of Vehicle Maintenance," H. Rossington, 7 p.m.
*Mon., Jan. 11th.*—SCOTTISH CENTRE: North British Station Hotel, Edinburgh, "Lighting for Commercial Vehicles and Its Contribution to Road Safety," J. H. Nelson, 7.30 p.m.
*Tues., Jan. 12th.*—MIDLANDS CENTRE: Crown Inn, Birmingham, "Carburation," L. J. Spencer, 7.30 p.m.
*Wed., Jan. 13th.*—E. MIDLANDS CENTRE: Mechanics Institute, Nottingham, "The Design of Automotive Piston and Ring Assemblies," L. Howell, 7.30 p.m.
*Thurs., Jan. 14th.*—WESTERN CENTRE: Grand Hotel, Bristol, Brains Trust, 7.30 p.m.

### INSTITUTE OF TRANSPORT

*Mon., Jan. 11th.*—ORDINARY MEETING: Jarvis Hall, 66, Portland Place, London, W.1, "Transport in the Municipal Field: Problems of the Day," W. M. Little, 5.45 p.m.

### INSTITUTION OF BRITISH AGRICULTURAL ENGINEERS

*Tues., Jan. 12th.*—Institution of Electrical Engineers, Savoy Place, London, W.C.2, "The Control of Weeds by Tillage," F. Coleman, 2.15 p.m.

### INSTITUTION OF CIVIL ENGINEERS

*Tues., Jan. 12th.*—AIRPORT MEETING: Great George Street, Westminster, London, S.W.1, "The Control of Aircraft Movement at Airports," Clifford Heyes and E. J. Dickie, 5.30 p.m.
*Thurs., Jan. 14th.*—MIDLANDS ASSOCIATION: James Watt Memorial Institute, Great Charles Street, Birmingham, "Problems of Water Supply in Arid Regions," F. W. Shotton, 6 p.m.
*Tues., Jan. 19th.*—ORDINARY MEETING: Great George Street, Westminster, London, S.W.1, "The Engineer's Task in Future Wars," G. N. Tuck, 5.30 p.m.

### INSTITUTION OF ELECTRICAL ENGINEERS

*Mon., Jan. 11th.*—LONDON STUDENTS' SECTION: Savoy Place, London, W.C.2, Film Evening, 7 p.m.
*Wed., Jan. 13th.*—RADIO SECTION: Savoy Place, London, W.C.2, "A Single-Sideband Controlled-Carrier System for Aircraft Communication," G. W. Barnes, 5.30 p.m.
*Mon., Jan. 18th.*—INFORMAL MEETING: Savoy Place, London, W.C.2, Discussion on "The Role of the Consulting Engineer," opened by T. G. N. Haldane, 5.30 p.m.
*Tues., Jan. 19th.*—MEASUREMENTS SECTION: Savoy Place, London, W.C.2, Discussion on "High-Sensitivity Wattmeters," opened by A. H. M. Arnold, 5.30 p.m.——N. MIDLAND CENTRE: British Electricity Authority, 1, Whitehall Road, Leeds, 1, "The Royal Festival Hall Electrical Installation," 6.30 p.m.

### INSTITUTION OF ENGINEERING INSPECTION

*Wed., Jan. 20th.*—DUNDEE BRANCH: Royal British Hotel, Dundee, "Manufacture of Gauges and Measuring Instruments," J. B. Perry, 7.30 p.m.——WOLVERHAMPTON BRANCH: Visit to The Quasi-Arc Company, Ltd., Bilston, 3 p.m.

### INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND

*Tues., Jan. 12th.*—39, Elmbank Crescent, Glasgow, "The Manufacture of Small Refrigeration Units," S. H. Pearson, 6.45 p.m.
*Thurs., Jan. 14th.*—University College, Dundee, Joint Meeting with the Dundee Institute of Engineers, "The Manufacture of Small Refrigeration Units," S. H. Pearson, 7.15 p.m.

### INSTITUTION OF LOCOMOTIVE ENGINEERS

*Wed., Jan. 20th.*—Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, "The Wearing Parts of Electric Rolling Stock—A Review of the Experience on the London Transport System," A. W. Manser, 5.30 p.m.

### INSTITUTION OF MECHANICAL ENGINEERS

*To-day, Jan. 8th.*—GENERAL MEETING: Storey's Gate, St. James's Park, London, S.W.1, "An Experimental Investigation into the Effect of Fuel Addition to the Intake Air on Performance of a Compression-Ignition Engine," W. T. Lyn; "The Effect of Auxiliary Fuels on the Smoke-Limited Power Output of Diesel Engines," L. D. Derry, E. M. Dodds, E. B. Evans and D. Royle, 5.30 p.m.
*Tues., Jan. 12th.*—A.D. GENERAL MEETING: Storey's Gate, St. James's Park, London, S.W.1, "Two-Stroke Automotive Compression-Ignition Engines," Hans List, 5.30 p.m.——S. WALES BRANCH: Mackworth Hotel, Swansea, Annual General Meeting, "U.K. Oil Refinery Expansion: Development at Llandarcy Refinery," I. Cameron, 6 p.m.
*Wed., Jan. 13th.*—WESTERN BRANCH, GRADUATES' SECTION: Grand Hotel, Bristol, "Caustic Cracking in Boiler Seams and its Detection by the Ultrasonic Method," N. V. Worthington, 7 p.m.
*Thurs., Jan. 14th.*—N.W. BRANCH: Engineers' Club, Albert Square, Manchester, "Contemporary Methods of Watch Production," R. A. Fell and P. Indermuhle, 6.45 p.m.——SCOTTISH BRANCH, GRADUATES' SECTION: Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, "Ultrasonics," W. W. Wilson, 7.30 p.m.
*Fri., Jan. 15th.*—GENERAL MEETING: Storey's Gate, St. James's Park, London, S.W.1, Thomas Lowe Gray Lecture: "High Temperature Steam and Gas Turbine Machinery for Marine Propulsion," T. W. F. Brown, 5.30 p.m.

### INSTITUTION OF PRODUCTION ENGINEERS

*To-day, Jan. 8th.*—EASTERN COUNTIES SECTION: The Diocesan Hall, Tower Street, Ipswich, "The Production of Woven Artificial Silk Fabrics," E. H. Boas and N. Ray.
*Mon., Jan. 11th.*—SHEFFIELD SECTION: Grand Hotel, Sheffield, "Extrusion of Metals," J. T. Lewis, 6.30 p.m.——YORKSHIRE SECTION: Hotel Metropole, Leeds, "Electronics as an Aid to Productivity," R. McKennell, 7 p.m.
*Wed., Jan. 13th.*—PRESTON SECTION: Crown Hotel, Blackburn, "The Design of Sintered Metal Parts," G. R. Bell, 7.15 p.m.
*Thurs., Jan. 14th.*—LONDON SECTION: Royal Empire Society, Northumberland Avenue, London, W.C.2, "Fabrication and Welding of Armoured Steels," J. W. Brind, 7 p.m.——LEICESTER AND DISTRICT SECTION: Bell Hotel, Leicester, "The Application of Milling Cutters," Mr. Loudon, 7 p.m.——READING SECTION: Great Western Hotel, Reading, Film, "Sharp Edge of the World," 7.30 p.m.
*Fri., Jan. 15th.*—Mackworth Hotel, Swansea, "Horological Manufacture over the last Half Century," H. M. Walford, 7 p.m.

### INSTITUTION OF STRUCTURAL ENGINEERS

*Tues., Jan. 12th.*—LANCASHIRE AND CHESHIRE BRANCH: College of Technology, Liverpool, "The Plastic Theory and its Application to Welded Structures," 7.15 p.m.
*Thurs., Jan. 14th.*—11, Upper Belgrave Street, London, S.W.1, "Soil Stabilisation of Fine Materials," S. J. Crispin, 5.55 p.m.

### JUNIOR INSTITUTION OF ENGINEERS

*To-day, Jan. 8th.*—Townsend House, Greycoat Place, London, S.W.1, "A Modern Vehicle Actuated Detector and Its Development," H. J. N. Riddle, 7 p.m.
*Mon., Jan. 11th.*—SHEFFIELD AND DISTRICT SECTION: Livesey Clegg House, Sheffield, "Clean City Air—An Engineers' Problem," James Law, 7.30 p.m.——N.W. SECTION: Engineers' Club, Albert Square, Manchester, Chairman's Address, A. R. Bateman, Part I: "The Junior Associations," Part II: "The Training of Supervisory Staff and Foremen," 7.30 p.m.
*Fri., Jan. 15th.*—Townsend House, Greycoat Place, London, S.W.1, "Coal Tar Fuels," E. Brett Davies, 7 p.m.

### LIVERPOOL METALLURGICAL SOCIETY

*Thurs., Jan. 14th.*—Liverpool Engineering Society, The Temple, Dale Street, Liverpool, Open Discussion on "The Corrosion and Preservation of Metals," 7 p.m.

### MANCHESTER ASSOCIATION OF ENGINEERS

*To-day, Jan. 8th.*—Engineers' Club, Albert Square, Manchester, "The Training of Designer-Draughtsmen," Discussion, 6.45 p.m.

### NEWCOMEN SOCIETY

*Wed., Jan. 13th.*—Iron and Steel Institute, 4, Grosvenor Gardens, London, S.W.1, "Some Notes on the Origins of Mechanical Servo Mechanisms," H. G. Conway, 5.30 p.m.

### NORTH EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS

*Fri., Jan. 15th.*—Mining Institute, Newcastle upon Tyne, "Metallurgical Aspects of High Temperature Steam and Gas Turbine Plants," J. M. Robertson, 6.15 p.m.

### SOCIETY OF CHEMICAL INDUSTRY

*Tues., Jan. 12th.*—Geological Society, Burlington House, London, W.1, "Engineering and Microbiological Processes," F. E. Warner, 5.30 p.m.

### SOCIETY OF INSTRUMENT TECHNOLOGY

*Thurs., Jan. 14th.*—CONTROL SECTION: Manson House, Portland Place, London, W.1, Annual General Meeting, "The Theory and Design of Compound Action Automatic Controllers with particular reference to the Interaction Factor," H. Williamson, 6.30 p.m.